Part No. 8163

TOYOTA

PICK-UPS / LAND CRUISER / 4RUNNER
1989-96 REPAIR MANUAL

CHILTON'S

Covers all U.S. and Canadian models of
Pick-Up, Tacoma, T100, Land Cruiser and 4Runner;
2 and 4 wheel drive

WIRING AND
VACUUM DIAGRAMS

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TOYOTA

PICK-UPS/LAND CRUISER/4RUNNER
1989-96 REPAIR MANUAL

CHILTON'S

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SAFETY NOTICE

Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles, as well as the personal safety of those performing repairs. This manual outlines procedures for servicing and repairing vehicles using safe, effective methods. The procedures contain many NOTES, CAUTIONS and WARNINGS which should be followed along with standard procedures to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

It is important to note that the repair procedures and techniques, tools and parts for servicing motor vehicles, as well as the skill and experience of the individual performing the work vary widely. It is not possible to anticipate all of the conceivable ways or conditions under which vehicles may be serviced, or to provide cautions as to all of the possible hazards that may result. Standard and accepted safety precautions and equipment should be used when handling toxic or flammable fluids, and safety goggles or other protection should be used during cutting, grinding, chiseling, prying, or any other process that can cause material removal or projectiles.

Some procedures require the use of tools specially designed for a specific purpose. Before substituting another tool or procedure, you must be completely satisfied that neither your personal safety, nor the performance of the vehicle will be endangered.

Although information in this manual is based on industry sources and is complete as possible at the time of publication, the possibility exists that some car manufacturers made later changes which could not be included here. While striving for total accuracy, Chilton Book Company cannot assume responsibility for any errors, changes or omissions that may occur in the compilation of this data.

PART NUMBERS

Part numbers listed in this reference are not recommendation by Chilton for any product by brand name. They are references that can be used with interchange manuals and aftermarket supplier catalogs to locate each brand supplier's discrete part number.

SPECIAL TOOLS

Special tools are recommended by the vehicle manufacturer to perform their specific job. Use has been kept to a minimum, but where absolutely necessary, they are referred to in the text by the part number of the tool manufacturer. These tools can be purchased, under the appropriate part number, from your local dealer or regional distributor, or an equivalent tool can be purchased locally from a tool supplier or parts outlet. Before substituting any tool for the one recommended, read the SAFETY NOTICE at the top of this page.

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HOW TO USE THIS BOOK

Chilton's Total Car Care manual for the Toyota Truck is intended to help you learn more about the inner workings of your vehicle while saving you money on its upkeep and operation.

The beginning of the book will likely be referred to the most, since that is where you will find information for maintenance and tune-up. The other sections deal with the more complex systems of your vehicle. Operating systems from engine through brakes are covered to the extent that the average do-it-yourselfer becomes mechanically involved. This book will not explain such things as rebuilding a differential for the simple reason that the expertise required and the investment in special tools make this task uneconomical. It will, however, give you detailed instructions to help you change your own brake pads and shoes, replace spark plugs, and perform many more jobs that can save you money, give you personal satisfaction and help you avoid expensive problems.

A secondary purpose of this book is a reference for owners who want to understand their vehicle and/or their mechanics better. In this case, no tools at all are required.

Where to Begin

Before removing any bolts, read through the entire procedure. This will give you the overall view of what tools and supplies will be required. There is nothing more frustrating than having to walk to the bus stop on Monday morning because you were short one bolt on Sunday afternoon. So read ahead and plan ahead. Each operation should be approached logically and all procedures thoroughly understood before attempting any work.

All sections contain adjustments, maintenance, removal and installation procedures, and in some cases, repair or overhaul procedures. When repair is not considered practical, we tell you how to remove the part and then how to install the new or rebuilt replacement. In this way, you at least save the labor costs. Backyard repair of some components is just not practical.

Avoiding Trouble

Many procedures in this book require you to "label and disconnect . . . " a group of lines, hoses or wires. Don't be lulled into thinking you can remember where everything goes — you won't. If you hook up vacuum or fuel lines incorrectly, the vehicle will run poorly, if at all. If you hook up electrical wiring incorrectly, you may instantly learn a very expensive lesson.

You don't need to know the official or engineering name for each hose or line. A piece of masking tape on the hose and a piece on its fitting will allow you to assign your own label such as the letter A or a short name. As long as you remember your own code, the lines can be reconnected by matching similar letters or names. Do remember that tape will dissolve in gasoline or other fluids; if a component is to be washed or cleaned, use another method of identification. A permanent felt-tipped marker can be very handy for marking metal parts. Remove any tape or paper labels after assembly.

Maintenance or Repair?

It's necessary to mention the difference between maintenance and repair. Maintenance includes routine inspections, adjustments, and replacement of parts which show signs of normal wear. Maintenance compensates for wear or deterioration. Repair implies that something has broken or is not working. A need for repair is often caused by lack of maintenance. Example: draining and refilling the automatic transmission fluid is maintenance recommended by the manufacturer at specific mileage intervals. Failure to do this can ruin the transmission/transaxle, requiring very expensive repairs. While no maintenance program can prevent items from breaking or wearing out, a general rule can be stated: MAINTENANCE IS CHEAPER THAN REPAIR.

Two basic mechanic's rules should be mentioned here. First, whenever the left side of the vehicle or engine is referred to, it is meant to specify the driver's side. Conversely, the right side of the vehicle means the passenger's side. Second, most screws and bolts are removed by turning counterclockwise, and tightened by turning clockwise.

Safety is always the most important rule. Constantly be aware of the dangers involved in working on an automobile and take the proper precautions. See the information in this section regarding SERVICING YOUR VEHICLE SAFELY and the SAFETY NOTICE on the acknowledgment page.

Avoiding the Most Common Mistakes

Pay attention to the instructions provided. There are 3 common mistakes in mechanical work:

1. Incorrect order of assembly, disassembly or adjustment. When taking something apart or putting it together, performing steps in the wrong order usually just costs you extra time; however, it CAN break something. Read the entire procedure before beginning disassembly. Perform everything in the order in which the instructions say you should, even if you can't immediately see a reason for it. When you're taking apart something that is very intricate, you might want to draw a picture of how it looks when assembled at one point in order to make sure you get everything back in its proper position. We will supply exploded views whenever possible. When making adjustments, perform them in the proper order; often, one adjustment affects another, and you cannot expect even satisfactory results unless each adjustment is made only when it cannot be changed by any other.

2. Overtorquing (or undertorquing). While it is more common for overtorquing to cause damage, undertorquing may allow a fastener to vibrate loose causing serious damage. Especially when dealing with aluminum parts, pay attention to torque specifications and utilize a torque wrench in assembly. If a torque figure is not available, remember that if you are using the right tool to perform the job, you will probably not have to strain yourself to get a fastener tight enough. The pitch of most threads is so slight that the tension you put on the wrench will be multiplied many times in actual force on what you are tightening. A good example of how critical torque is can be seen in the case of spark plug installation, especially

where you are putting the plug into an aluminum cylinder head. Too little torque can fail to crush the gasket, causing leakage of combustion gases and consequent overheating of the plug and engine parts. Too much torque can damage the threads or distort the plug, changing the spark gap.

There are many commercial products available for ensuring that fasteners won't come loose, even if they are not torqued just right (a very common brand is Loctite®). If you're worried about getting something together tight enough to hold, but loose enough to avoid mechanical damage during assembly, one of these products might offer substantial insurance. Before choosing a threadlocking compound, read the label on the package and make sure the product is compatible with the materials, fluids, etc. involved.

3. Crossthreading. This occurs when a part such as a bolt is screwed into a nut or casting at the wrong angle and forced. Crossthreading is more likely to occur if access is difficult. It helps to clean and lubricate fasteners, then to start threading with the part to be installed positioned straight in. Then, start the bolt, spark plug, etc. with your fingers. If you encounter resistance, unscrew the part and start over again at a different angle until it can be inserted and turned several times without much effort. Keep in mind that many parts, especially spark plugs, have tapered threads, so that gentle turning will automatically bring the part you're threading to the proper angle, but only if you don't force it or resist a change in angle. Don't put a wrench on the part until it's been tightened a couple of turns by hand. If you suddenly encounter resistance, and the part has not seated fully, don't force it. Pull it back out to make sure it's clean and threading properly.

Always take your time and be patient; once you have some experience, working on your vehicle may well become an enjoyable hobby.

TOOLS AND EQUIPMENT

▸ See Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14

Naturally, without the proper tools and equipment it is impossible to properly service your vehicle. It would also be virtually impossible to catalog every tool that you would need to perform all of the operations in this book. Of course, It would be unwise for the amateur to rush out and buy an expensive set of tools on the theory that he/she may need one or more of them at some time.

The best approach is to proceed slowly, gathering a good quality set of those tools that are used most frequently. Don't be misled by the low cost of bargain tools. It is far better to spend a little more for better quality. Forged wrenches, 6 or 12-point sockets and fine tooth ratchets are by far preferable to their less expensive counterparts. As any good mechanic can tell you, there are few worse experiences than trying to work on a vehicle with bad tools. Your monetary savings will be far outweighed by frustration and mangled knuckles.

Begin accumulating those tools that are used most frequently: those associated with routine maintenance and tune-up. In addition to the normal assortment of screwdrivers and pliers, you should have the following tools:

- Wrenches/sockets and combination open end/box end wrenches in sizes from $^1/_8$-$^3/_4$ in. or 3mm-19mm (depending on whether your vehicle uses standard or metric fasteners) and a $^{13}/_{16}$ in. or $^5/_8$ in. spark plug socket (depending on plug type).

➡If possible, buy various length socket drive extensions. Universal-joint and wobble extensions can be extremely useful, but be careful when using them, as they can change the amount of torque applied to the socket.

- Jackstands for support.
- Oil filter wrench.
- Spout or funnel for pouring fluids.
- Grease gun for chassis lubrication (unless your vehicle is not equipped with any grease fittings — for details, please refer to information on Fluids and Lubricants found later in this section).
- Hydrometer for checking the battery (unless equipped with a sealed, maintenance-free battery).
- A container for draining oil and other fluids.
- Rags for wiping up the inevitable mess.

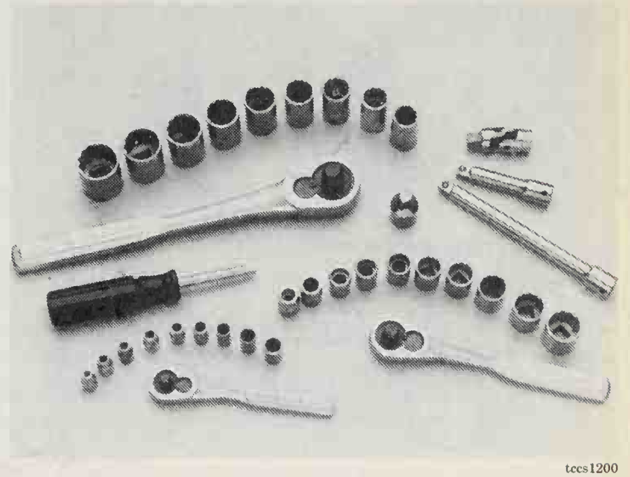

Fig. 1 All but the most basic procedures will require an assortment of ratchets and sockets

In addition to the above items there are several others that are not absolutely necessary, but handy to have around. These include Oil Dry® (or an equivalent oil absorbent gravel — such as cat litter) and the usual supply of lubricants, antifreeze and fluids, although these can be purchased as needed. This is a basic list for routine maintenance, but only your personal needs and desire can accurately determine your list of tools.

After performing a few projects on the vehicle, you'll be amazed at the other tools and non-tools on your workbench. Some useful household items are: a large turkey baster or siphon, empty coffee cans and ice trays (to store parts), ball of twine, electrical tape for wiring, small rolls of colored tape for tagging lines or hoses, markers and pens, a note pad, golf tees (for plugging vacuum lines), metal coat hangers or a roll of mechanics's wire (to hold things out of the way), dental pick or similar long, pointed probe, a strong magnet, and a small mirror (to see into recesses and under manifolds).

A more advanced set of tools, suitable for tune-up work, can be drawn up easily. While the tools are slightly more sophisticated, they need not be outrageously expensive. There are

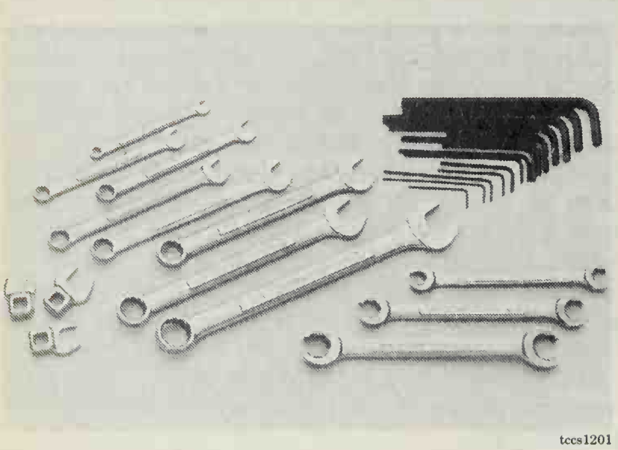

Fig. 2 In addition to ratchets, a good set of wrenches and hex keys will be necessary

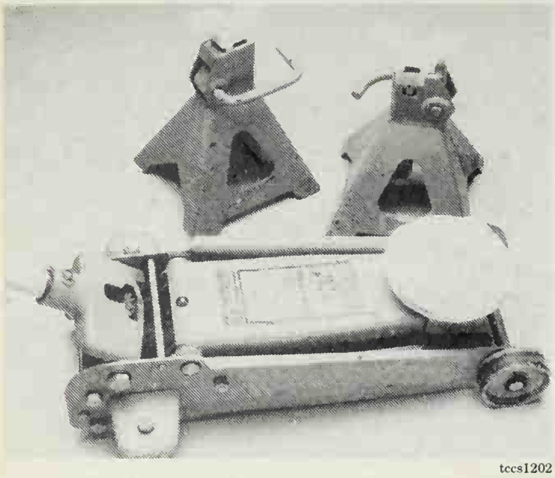

Fig. 3 A hydraulic floor jack and a set of jackstands are essential for lifting and supporting the vehicle

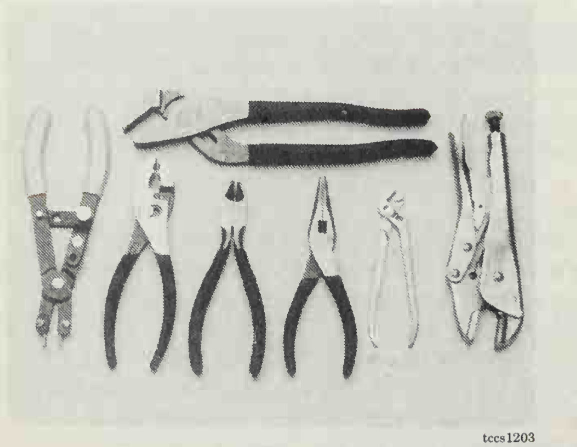

Fig. 4 An assortment of pliers, grippers and cutters will be handy, especially for old rusted parts and stripped bolt heads

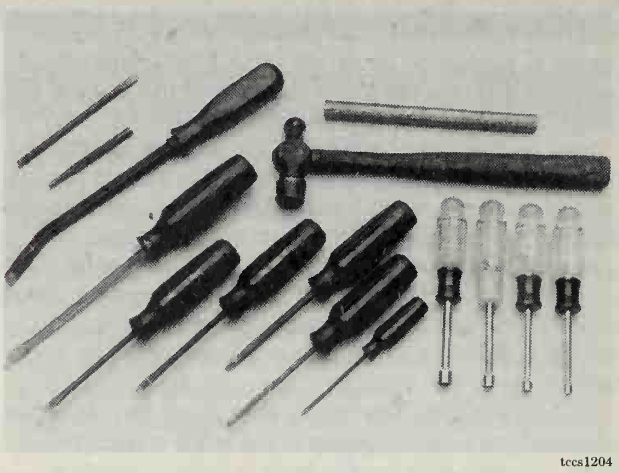

Fig. 5 Various drivers, chisels and prybars are great tools to have in your toolbox

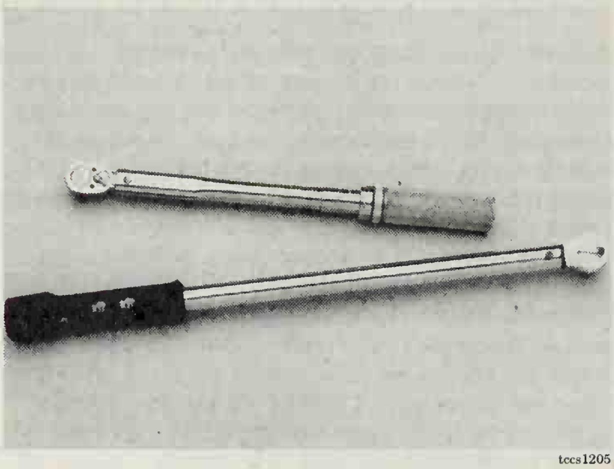

Fig. 6 Many repairs will require the use of a torque wrench to assure the components are properly fastened

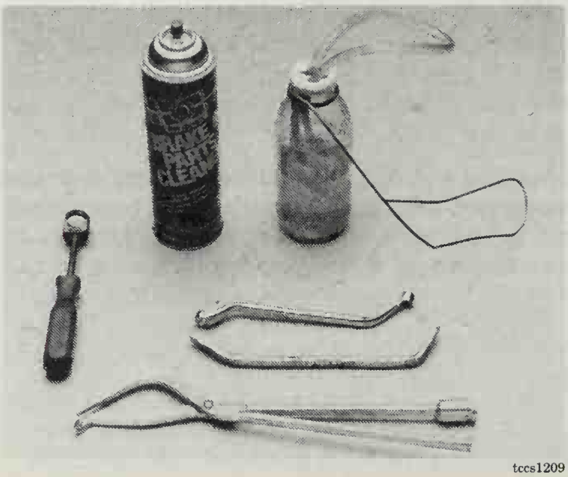
BRAKE PARTS CLEANER
tccs1209

Fig. 7 Although not always necessary, using specialized brake tools will save time

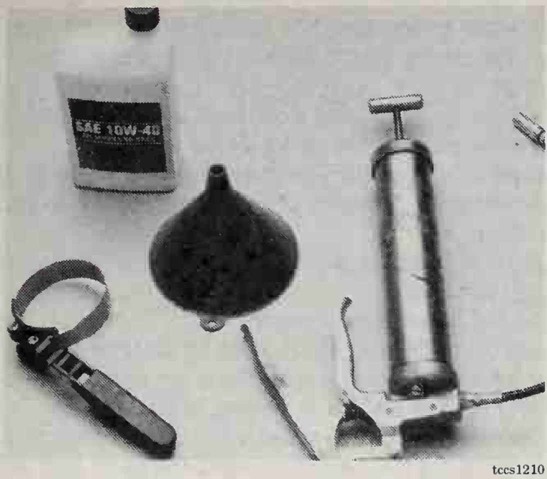
SAE 10W-40
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Fig. 8 A few inexpensive lubrication tools will make maintenance easier

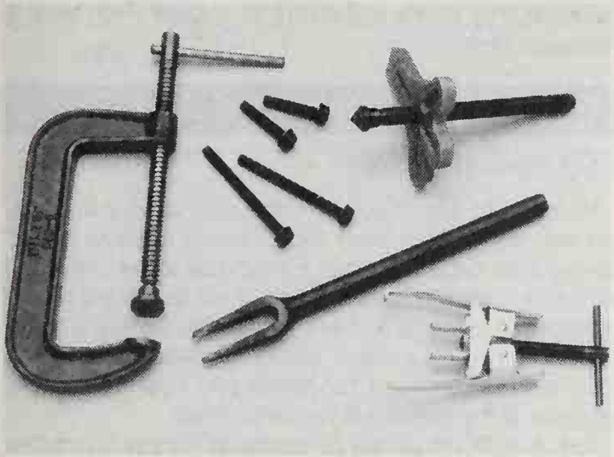


Fig. 9 Various pullers, clamps and separator tools are needed for many larger, more complicated repairs

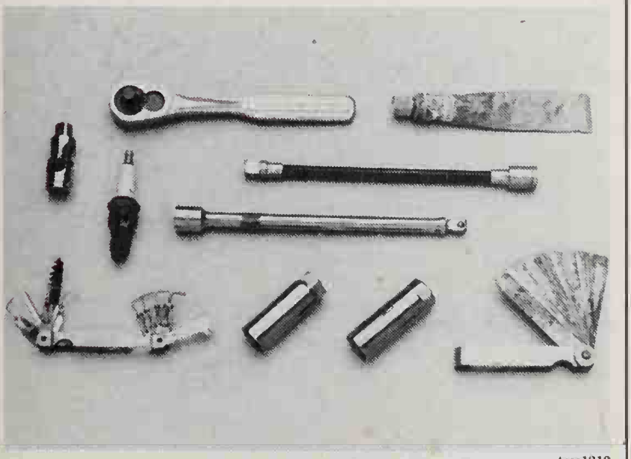


Fig. 10 A variety of tools and gauges should be used for spark plug gapping and installation

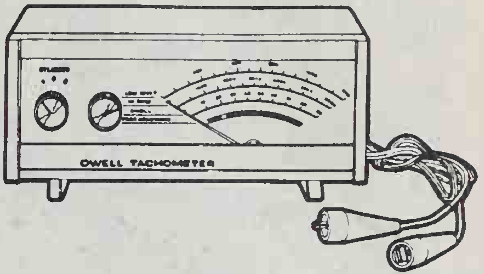

DWELL TACHOMETER
tccs1001

Fig. 11 Dwell/tachometer unit (typical)

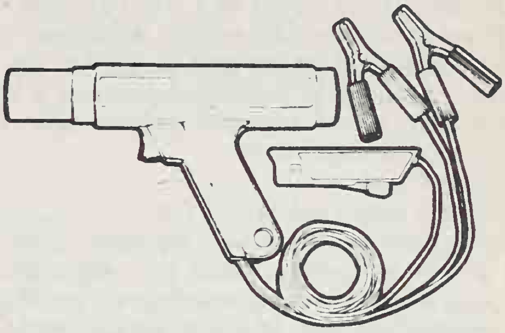


Fig. 12 Inductive type timing light

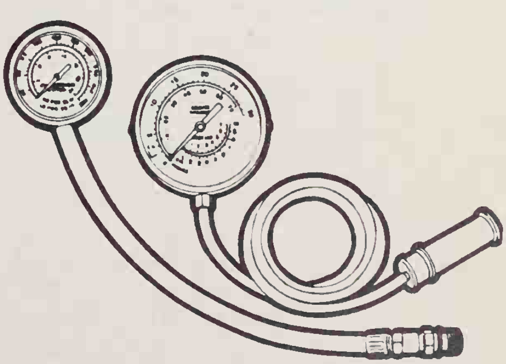


Fig. 13 Compression gauge and a combination vacuum/fuel pressure test gauge

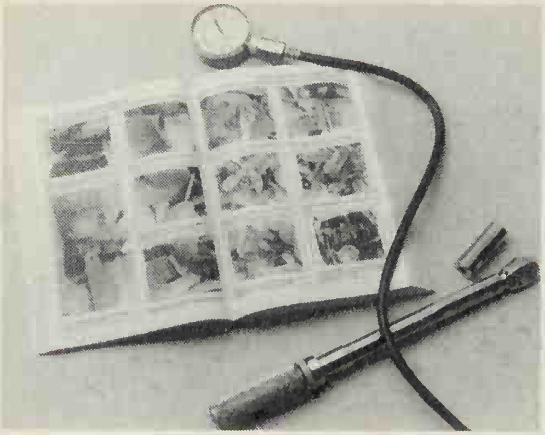


Fig. 14 The most important tool you need to do the job is the proper information, so always have a Chilton Total Car Care manual handy

several inexpensive tach/dwell meters on the market that are every bit as good for the average mechanic as a professional model. Just be sure that it goes to a least 1200-1500 rpm on the tach scale and that it works on 4, 6 and 8-cylinder engines. (If you have one or more vehicles with a diesel engine, a special tachometer is required since diesels don't use spark plug ignition systems). The key to these purchases is to make them with an eye towards adaptability and wide range. A basic list of tune-up tools could include:

- Tach/dwell meter.
- Spark plug wrench and gapping tool.
- Feeler gauges for valve or point adjustment. (Even if your vehicle does not use points or require valve adjustments, a feeler gauge is helpful for many repair/overhaul procedures).

A tachometer/dwell meter will ensure accurate tune-up work on vehicles without electronic ignition. The choice of a timing light should be made carefully. A light which works on the DC current supplied by the vehicle's battery is the best choice; it should have a xenon tube for brightness. On any vehicle with an electronic ignition system, a timing light with an inductive pickup that clamps around the No. 1 spark plug cable is preferred.

In addition to these basic tools, there are several other tools and gauges you may find useful. These include:

- Compression gauge. The screw-in type is slower to use, but eliminates the possibility of a faulty reading due to escaping pressure.
- Manifold vacuum gauge.
- 12V test light.
- A combination volt/ohmmeter
- Induction Ammeter. This is used for determining whether or not there is current in a wire. These are handy for use if a wire is broken somewhere in a wiring harness.

As a final note, you will probably find a torque wrench necessary for all but the most basic work. The beam type models are perfectly adequate, although the newer click types (breakaway) are easier to use. The click type torque wrenches tend to be more expensive. Also keep in mind that all types of torque wrenches should be periodically checked and/or recalibrated. You will have to decide for yourself which better fits your purpose.

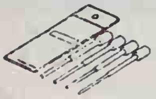
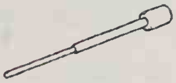
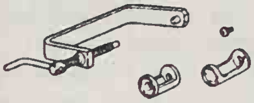
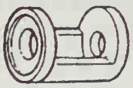
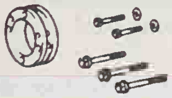
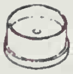
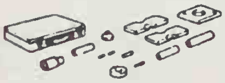
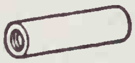
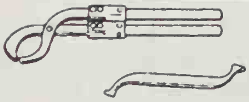
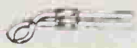
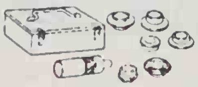
Special Tools

See Figure 15

Normally, the use of special factory tools is avoided for repair procedures, since these are not readily available for the do-it-yourself mechanic. When it is possible to perform the job with more commonly available tools, it will be pointed out, but occasionally, a special tool was designed to perform a specific function and should be used. Before substituting another tool, you should be convinced that neither your safety nor the performance of the vehicle will be compromised.

Special tools can usually be purchased from an automotive parts store or from your dealer. In some cases special tools may be available directly from the tool manufacturer.

SST (SPECIAL SERVICE TOOLS)

	09201-10000	Valve Guide Bushing Remover & Replacer Set	
	(09201-01070)	Valve Guide Bushing Remover & Replacer 7	
	09202-70020	Valve Spring Compressor	
	(09202-00010)	Attachment	
	09213-58012	Crankshaft Pulley Holding Tool	
	09223-15030	Oil Seal & Bearing Replacer	Crankshaft rear oil seal
	09236-00101	Water Pump Overhaul Tool Set	
	(09236-15010)	Bearing Stay	Valve stem oil seal
	09248-06020	Valve Lifter Stopper	
	09248-55050	Valve Clearance Adjust Tool Set	
	(09248-05510)	Valve Lifter Press	
	09316-60011	Transmission & Transfer Bearing Replacer	

86821016

Fig. 15 SST (special service tools) are occasionally necessary to perform a specific job or are recommended to make a job easier. These tools are sometimes similar to a common tool you may already have

SERVICING YOUR VEHICLE SAFETY

See Figures 16, 17, 18 and 19

It is virtually impossible to anticipate all of the hazards involved with automotive maintenance and service, but care and common sense will prevent most accidents.

The rules of safety for mechanics range from "don't smoke around gasoline," to "use the proper tool for the job." The trick to avoiding injuries is to develop safe work habits and to take every possible precaution.

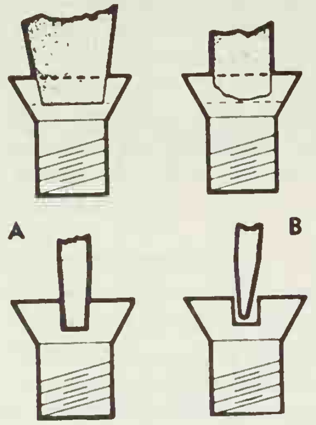


Fig. 16 Screwdrivers should be kept in good condition to prevent injury or damage which could result if the blade slips from the screw

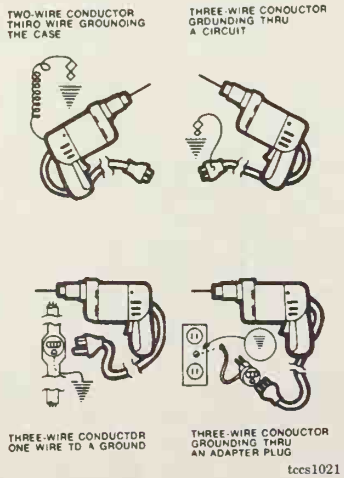

TWO-WIRE CONDUCTOR THIRD WIRE GROUNDING THE CASE
THREE-WIRE CONDUCTOR GROUNDING THRU A CIRCUIT
THREE-WIRE CONDUCTOR ONE WIRE TO A GROUND
THREE-WIRE CONDUCTOR GROUNDING THRU AN ADAPTER PLUG
tccs1021

Fig. 17 Power tools should always be properly grounded

Do's

- Do keep a fire extinguisher and first aid kit handy.
- Do wear safety glasses or goggles when cutting, drilling, grinding or prying, even if you have 20-20 vision. If you wear glasses for the sake of vision, wear safety goggles over your regular glasses.
- Do shield your eyes whenever you work around the battery. Batteries contain sulfuric acid. In case of contact with the eyes or skin, flush the area with water or a mixture of water and baking soda, then seek immediate medical attention.
- Do use safety stands (jackstands) for any undervehicle service. Jacks are for raising vehicles; jackstands are for making sure the vehicle stays raised until you want it to come down. Whenever the vehicle is raised, block the wheels remaining on the ground and set the parking brake.
- Do use adequate ventilation when working with any chemicals or hazardous materials. Like carbon monoxide, the asbestos dust resulting from some brake lining wear can be hazardous in sufficient quantities.
- Do disconnect the negative battery cable when working on the electrical system. The secondary ignition system contains EXTREMELY HIGH VOLTAGE. In some cases it can even exceed 50,000 volts.
- Do follow manufacturer's directions whenever working with potentially hazardous materials. Most chemicals and fluids are poisonous if taken internally.
- Do properly maintain your tools. Loose hammerheads, mushroomed punches and chisels, frayed or poorly grounded electrical cords, excessively worn screwdrivers, spread wrenches (open end), cracked sockets, slipping ratchets, or faulty droplight sockets can cause accidents.
- Likewise, keep your tools clean; a greasy wrench can slip off a bolt head, ruining the bolt and often harming your knuckles in the process.
- Do use the proper size and type of tool for the job at hand. Do select a wrench or socket that fits the nut or bolt. The wrench or socket should sit straight, not cocked.
- Do, when possible, pull on a wrench handle rather than push on it, and adjust your stance to prevent a fall.
- Do be sure that adjustable wrenches are tightly closed on the nut or bolt and pulled so that the force is on the side of the fixed jaw.
- Do strike squarely with a hammer; avoid glancing blows.
- Do set the parking brake and block the drive wheels if the work requires a running engine.

Don'ts

- Don't run the engine in a garage or anywhere else without proper ventilation — EVER! Carbon monoxide is poisonous; it takes a long time to leave the human body and you can build up a deadly supply of it in your system by simply breathing in a little every day. You may not realize you are slowly poisoning yourself. Always use power vents, windows, fans and/or open the garage door.

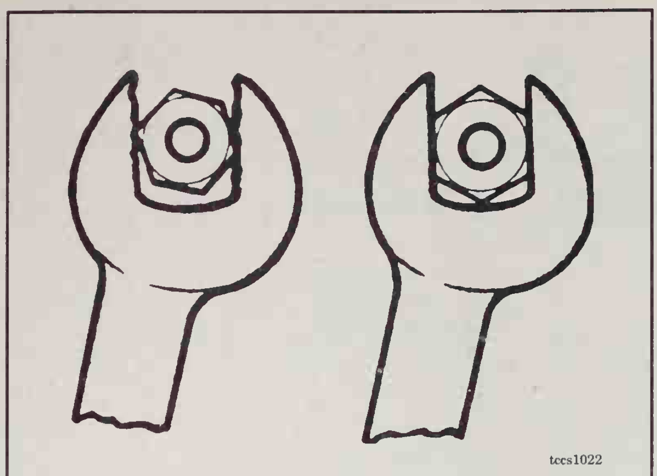


Fig. 18 Using the correct size wrench will help prevent the possibility of rounding-off a nut

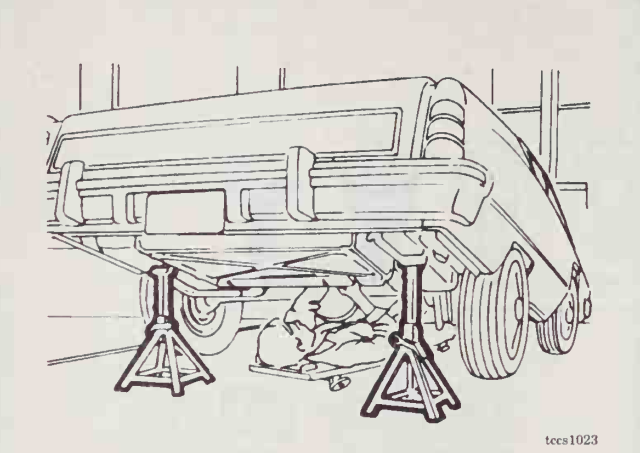


Fig. 19 NEVER work under a vehicle unless it is supported using safety stands (jackstands)

- Don't work around moving parts while wearing loose clothing. Short sleeves are much safer than long, loose sleeves. Hard-toed shoes with neoprene soles protect your toes and give a better grip on slippery surfaces. Jewelry such as watches, fancy belt buckles, beads or body adornment of any kind is not safe working around a vehicle. Long hair should be tied back under a hat or cap.
- Don't use pockets for toolboxes. A fall or bump can drive a screwdriver deep into your body. Even a rag hanging from your back pocket can wrap around a spinning shaft or fan.
- Don't smoke when working around gasoline, cleaning solvent or other flammable material.
- Don't smoke when working around the battery. When the battery is being charged, it gives off explosive hydrogen gas.
- Don't use gasoline to wash your hands; there are excellent soaps available. Gasoline contains dangerous additives which can enter the body through a cut or through your pores. Gasoline also removes all the natural oils from the skin so that bone dry hands will suck up oil and grease.
- Don't service the air conditioning system unless you are equipped with the necessary tools and training. When liquid or compressed gas refrigerant is released to atmospheric pressure it will absorb heat from whatever it contacts. This will chill or freeze anything it touches. Although refrigerant is normally non-toxic, R-12 becomes a deadly poisonous gas in the presence of an open flame. One good whiff of the vapors from burning refrigerant can be fatal.
- Don't use screwdrivers for anything other than driving screws! A screwdriver used as an prying tool can snap when you least expect it, causing injuries. At the very least, you'll ruin a good screwdriver.
- Don't use a bumper or emergency jack (that little ratchet, scissors, or pantograph jack supplied with the vehicle) for anything other than changing a flat! These jacks are only intended for emergency use out on the road; they are NOT designed as a maintenance tool. If you are serious about maintaining your vehicle yourself, invest in a hydraulic floor jack of at least a 1½ ton capacity, and at least two sturdy jackstands.

FASTENERS, MEASUREMENTS AND CONVERSIONS

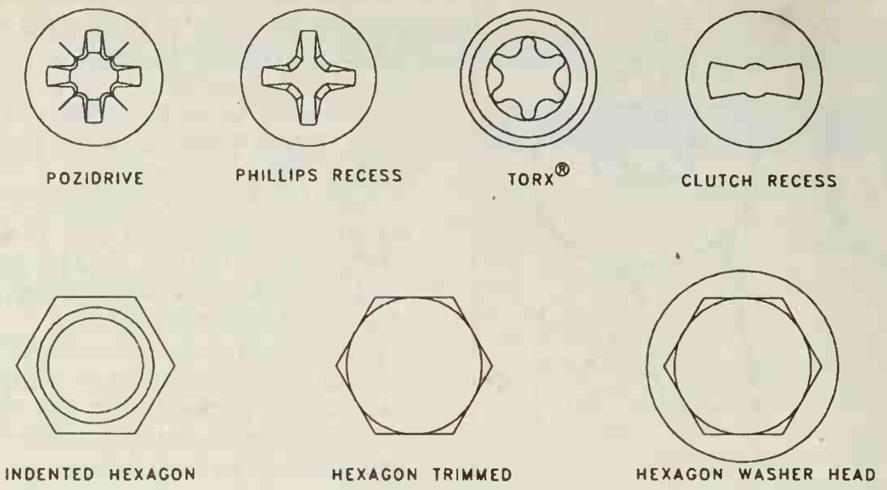
Bolts, Nuts and Other Threaded Retainers

➧ See Figures 20, 21, 22 and 23

Although there are a great variety of fasteners found in the modern car or truck, the most commonly used retainer is the threaded fastener (nuts, bolts, screws, studs, etc). Most threaded retainers may be reused, provided that they are not damaged in use or during the repair. Some retainers (such as stretch bolts or torque prevailing nuts) are designed to deform when tightened or in use and should not be reinstalled.

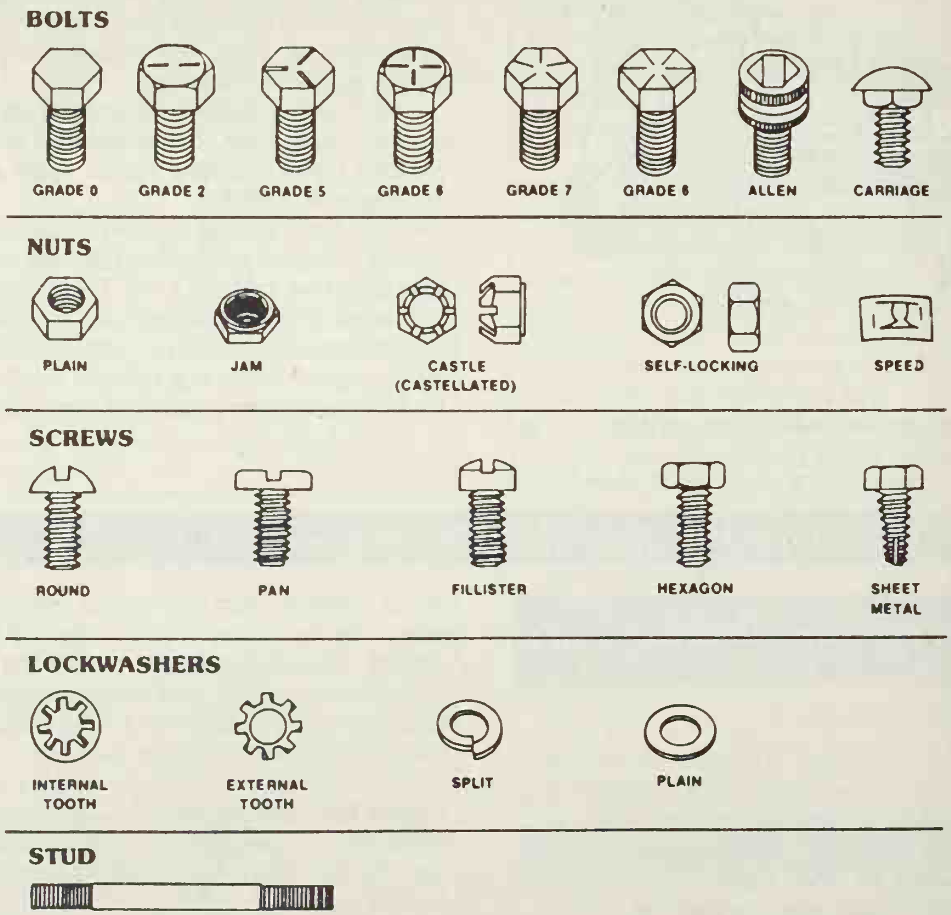
Whenever possible, we will note any special retainers which should be replaced during a procedure. But you should always inspect the condition of a retainer when it is removed and replace any that show signs of damage. Check all threads for rust or corrosion which can increase the torque necessary to achieve the desired clamp load for which that fastener was originally selected. Additionally, be sure that the driver surface of the fastener has not been compromised by rounding or other damage. In some cases a driver surface may become only partially rounded, allowing the driver to catch in only one direction. In many of these occurrences, a fastener may be installed and tightened, but the driver would not be able to grip and loosen the fastener again. (This could lead to frustration down the line should that component ever need to be disassembled again).

If you must replace a fastener, whether due to design or damage, you must ALWAYS be sure to use the proper replacement. In all cases, a retainer of the same design, material and strength should be used. Markings on the heads of most bolts will help determine the proper strength of the fast-


POZIDRIVE
PHILLIPS RECESS
TORX®
CLUTCH RECESS
INDENTED HEXAGON
HEXAGON TRIMMED
HEXAGON WASHER HEAD

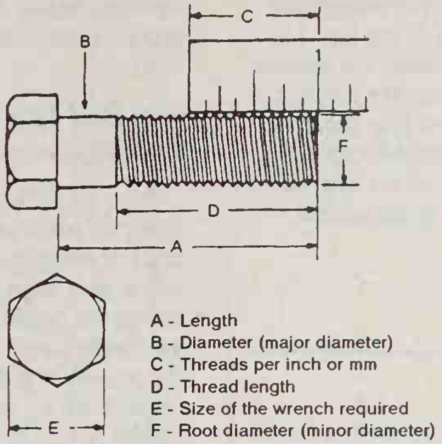
tccs1037

Fig. 20 Here are a few of the most common screw/bolt driver styles


BOLTS
GRADE 0
GRADE 2
GRADE 5
GRADE 6
GRADE 7
GRADE 8
ALLEN
CARRIAGE
NUTS
PLAIN
JAM
CASTLE
(CASTELLATED)
SELF-LOCKING
SPEED
SCREWS
ROUND
PAN
FILLISTER
HEXAGON
SHEET
METAL
LOCKWASHERS
INTERNAL
TOOTH
EXTERNAL
TOOTH
SPLIT
PLAIN
STUD

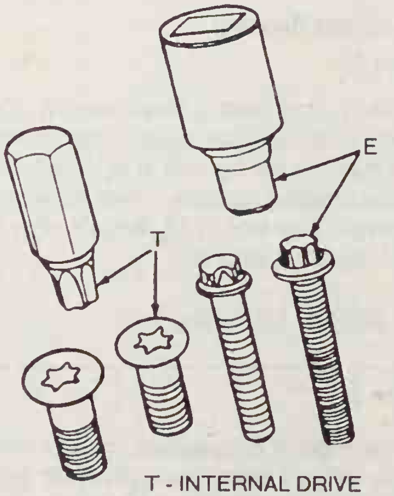
tccs1036

Fig. 21 There are many different types of threaded retainers found on vehicles


C
B
1
F
D
A
E
A - Length
B - Diameter (major diameter)
C - Threads per inch or mm
D - Thread length
E - Size of the wrench required
F - Root diameter (minor diameter)

tccs1038

Fig. 22 Threaded retainer sizes are determined using these measurements



tccs1016

Fig. 23 Special fasteners such as these Torx® head bolts are used by manufacturers to discourage people from working on vehicles without the proper tools

ener. The same material, thread and pitch must be selected to assure proper installation and safe operation of the vehicle afterwards.

Thread gauges are available to help measure a bolt or stud's thread. Most automotive and hardware stores keep gauges available to help you select the proper size. In a pinch, you can use another nut or bolt for a thread gauge. If the bolt you are replacing is not too badly damaged, you can select a match by finding another bolt which will thread in its place. If you find a nut which threads properly onto the damaged bolt, then use that nut to help select the replacement bolt. If however, the bolt you are replacing is so badly damaged (broken or drilled out) that its threads cannot be used as a gauge, you might start by looking for another bolt (from the same assembly or a similar location on your vehicle) which will thread into the damaged bolt's mounting. If so, the other bolt can be used to select a nut; the nut can then be used to select the replacement bolt.

In all cases, be absolutely sure you have selected the proper replacement. Don't be shy, you can always ask the store clerk for help.

⁂WARNING

Be aware that when you find a bolt with damaged threads, you may also find the nut or drilled hole it was threaded into has also been damaged. If this is the case, you may have to drill and tap the hole, replace the nut or otherwise repair the threads. NEVER try to force a replacement bolt to fit into the damaged threads.

Torque

Torque is defined as the measurement of resistance to turning or rotating. It tends to twist a body about an axis of rotation. A common example of this would be tightening a threaded retainer such as a nut, bolt or screw. Measuring torque is one of the most common ways to help assure that a threaded retainer has been properly fastened.

When tightening a threaded fastener, torque is applied in three distinct areas, the head, the bearing surface and the clamp load. About 50 percent of the measured torque is used in overcoming bearing friction. This is the friction between the bearing surface of the bolt head, screw head or nut face and the base material or washer (the surface on which the fastener is rotating). Approximately 40 percent of the applied torque is used in overcoming thread friction. This leaves only about 10 percent of the applied torque to develop a useful clamp load (the force which holds a joint together). This means that friction can account for as much as 90 percent of the applied torque on a fastener.

TORQUE WRENCHES

➧ See Figures 24, 25 and 26

In most applications, a torque wrench can be used to assure proper installation of a fastener. Torque wrenches come in various designs and most automotive supply stores will carry a variety to suit your needs. A torque wrench should be used any time we supply a specific torque value for a fastener. A torque wrench can also be used if you are following the general guidelines in the accompanying charts. Keep in mind that because there is no worldwide standardization of fasteners, the charts are a general guideline and should be used with caution. Again, the general rule of "if you are using the right tool for the job, you should not have to strain to tighten a fastener" applies here.

Beam Type

➧ See Figure 27

The beam type torque wrench is one of the most popular types. It consists of a pointer attached to the head that runs the length of the flexible beam (shaft) to a scale located near the handle. As the wrench is pulled, the beam bends and the pointer indicates the torque using the scale.

Click (Breakaway) Type

➧ See Figure 28

Another popular design of torque wrench is the click type. To use the click type wrench you pre-adjust it to a torque setting. Once the torque is reached, the wrench has a reflex signalling feature that causes a momentary breakaway of the torque wrench body, sending an impulse to the operator's hand.

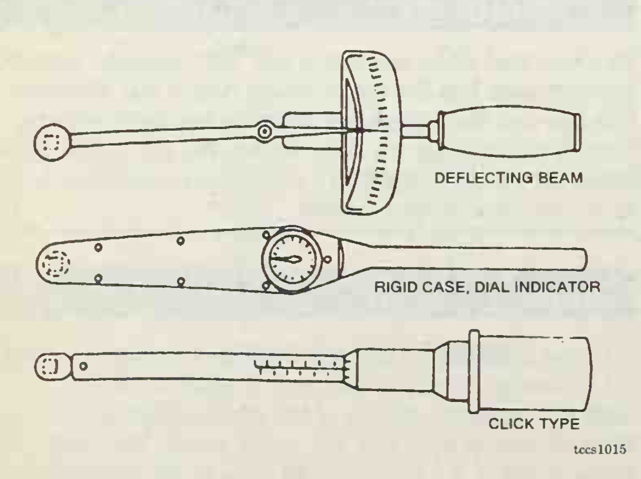


Fig. 24 Various styles of torque wrenches are usually available at your local automotive supply store

Pivot Head Type

➧ See Figures 28 and 29

Some torque wrenches (usually of the click type) may be equipped with a pivot head which can allow it to be used in areas of limited access. BUT, it must be used properly. To hold a pivot head wrench, grasp the handle lightly, and as you pull on the handle, it should be floated on the pivot point. If the handle comes in contact with the yoke extension during the process of pulling, there is a very good chance the torque readings will be inaccurate because this could alter the wrench loading point. The design of the handle is usually such as to make it inconvenient to deliberately misuse the wrench.

➡It should be mentioned that the use of any U-joint, wobble or extension will have an effect on the torque readings, no matter what type of wrench you are using. For the most accurate readings, install the socket directly on the wrench driver. If necessary, straight extensions (which hold a socket directly under the wrench driver) will have the least effect on the torque reading. Avoid any extension that alters the length of the wrench from the handle to the head/driving point (such as a crow's foot). U-joint or Wobble extensions can greatly affect the readings; avoid their use at all times.

Rigid Case (Direct Reading)

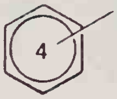
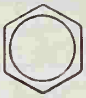
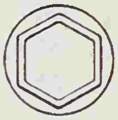
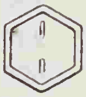
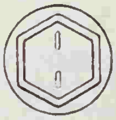
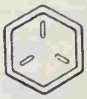
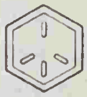
➧ See Figure 30

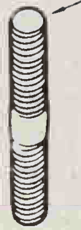
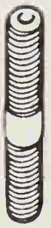
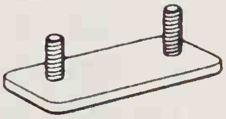
A rigid case or direct reading torque wrench is equipped with a dial indicator to show torque values. One advantage of these wrenches is that they can be held at any position on the wrench without affecting accuracy. These wrenches are often preferred because they tend to be compact, easy to read and have a great degree of accuracy.

TORQUE ANGLE METERS

➧ See Figure 31

Because the frictional characteristics of each fastener or threaded hole will vary, clamp loads which are based strictly on torque will vary as well. In most applications, this variance is not significant enough to cause worry. But, in certain applications, a manufacturer's engineers may determine that more precise clamp loads are necessary (such is the case with many aluminum cylinder heads). In these cases, a torque angle method of installation would be specified. When installing fasteners which are torque angle tightened, a predetermined seating torque and standard torque wrench are usually used first to remove any compliance from the joint. The fastener is then tightened the specified additional portion of a turn measured in degrees. A torque angle gauge (mechanical protractor) is used for these applications.

	Mark	Class
Hexagon head bolt	 Bolt head No. 4— 5— 6— 7— 8— 9— 10— 11—	4T 5T 6T 7T 8T 9T 10T 11T
	 No mark	4T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	7T
Hexagon head bolt	 Two protruding lines	8T
Hexagon flange bolt w/ washer hexagon bolt	 Two protruding lines	8T
Hexagon head bolt	 Three protruding lines	7T
Hexagon head bolt	 Four protruding lines	8T

	Mark	Class
Stud bolt	No mark 	4T
	Grooved 	6T
Welded bolt		4T

tccs1240

Fig. 25 Determining bolt strength of metric fasteners — NOTE: this is a typical bolt marking system, but there is not a worldwide standard

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

tccs1241

Fig. 26 Standard bolt torque for metric fasteners — WARNING: use only as a guide

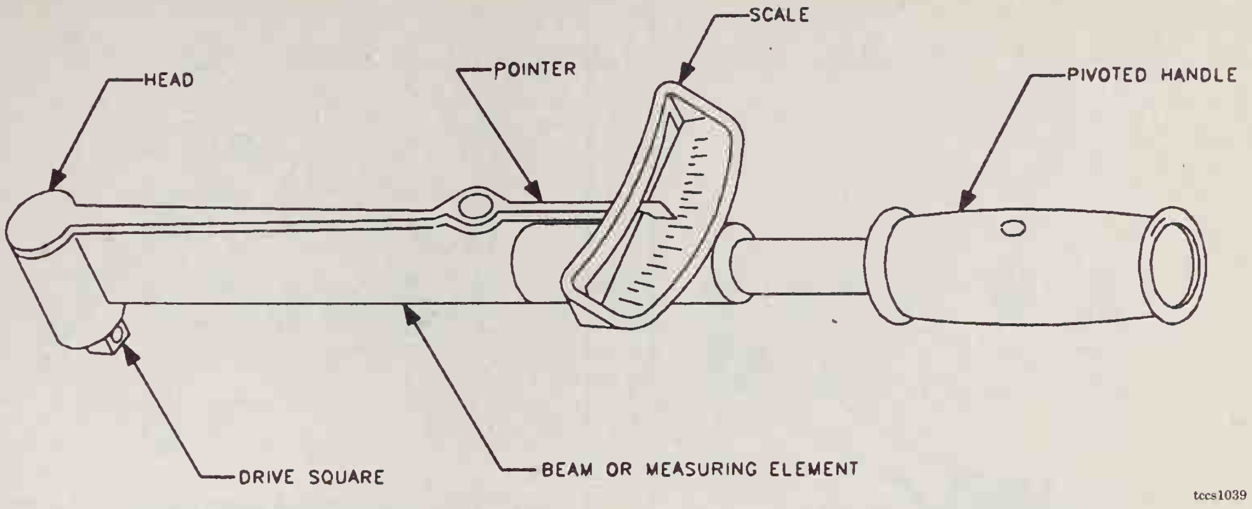

SCALE
HEAD
POINTER
PIVOTED HANDLE
DRIVE SQUARE
BEAM OR MEASURING ELEMENT
tccs1039

Fig. 27 Example of a beam type torque wrench

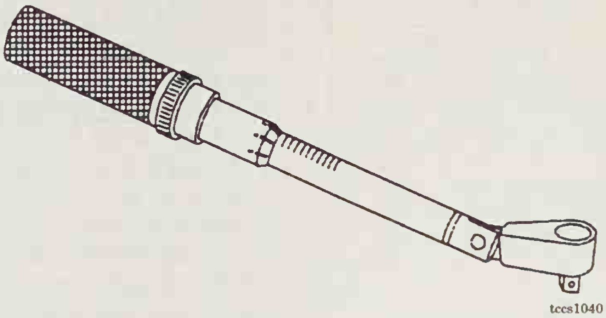


Fig. 28 A click type or breakaway torque wrench — note this one has a pivoting head

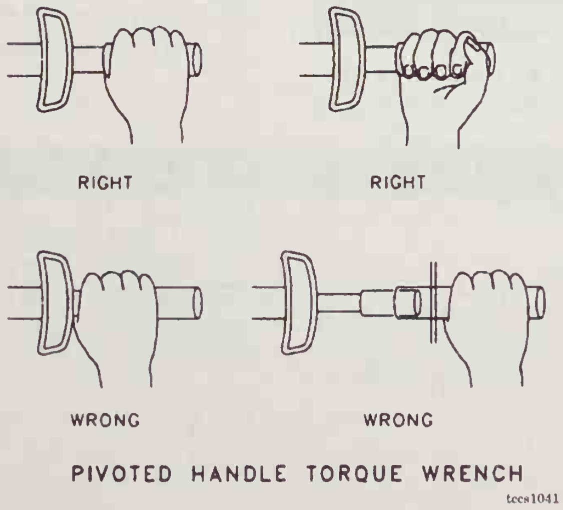

RIGHT
RIGHT
WRONG
WRONG
PIVOTED HANDLE TORQUE WRENCH
tccs1041

Fig. 29 Torque wrenches with pivoting heads must be grasped and used properly to prevent an incorrect reading

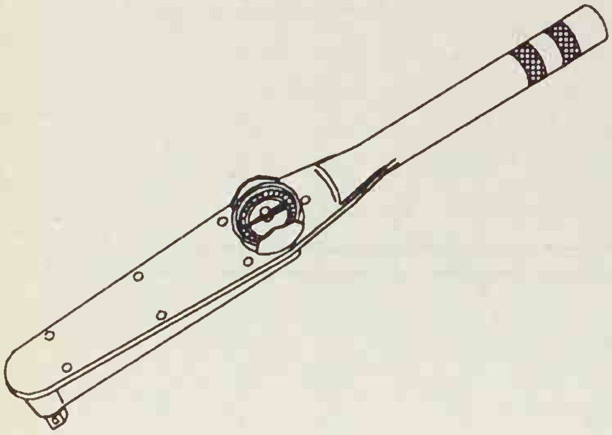

tccs1042

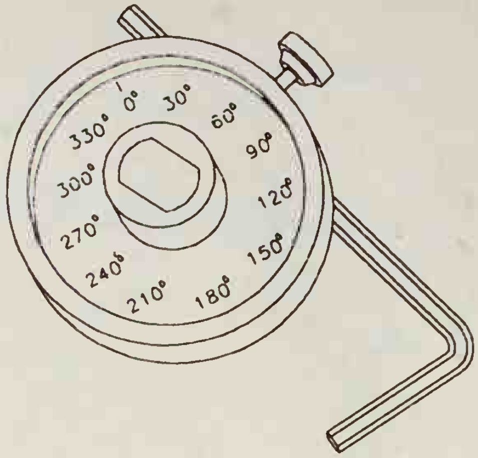
Fig. 30 The rigid case (direct reading) torque wrench uses a dial indicator to show torque

Standard and Metric Measurements

Throughout this manual, specifications are given to help you determine the condition of various components on your vehicle, or to assist you in their installation. Some of the most common measurements include length (in. or cm/mm), torque (ft. lbs., inch lbs. or Nm) and pressure (psi, in. Hg, kPa or mm Hg). In most cases, we strive to provide the proper measurement as determined by the manufacturer's engineers.

Though, in some cases, that value may not be conveniently measured with what is available in your toolbox. Luckily, many of the measuring devices which are available today will have two scales so the Standard or Metric measurements may easily be taken. If any of the various measuring tools which are available to you do not contain the same scale as listed in the specifications, use the conversion factors chart found at the end of this section to determine the proper value.

The conversion factor chart is used by taking the given specification and multiplying it by the necessary conversion factor. For instance, looking at the first line, if you have a measurement in inches such as "free-play should be 2 in." but your ruler reads only in millimeters, multiply 2 in. by the conversion factor of 25.4 to get the metric equivalent of 50.8mm. Likewise, if the specification was given only in a Metric measurement, for example in Newton Meters (Nm), then look at the center column first. If the measurement is 100 Nm, multiply it by the conversion factor of 0.738 to get 73.8 ft. lbs.



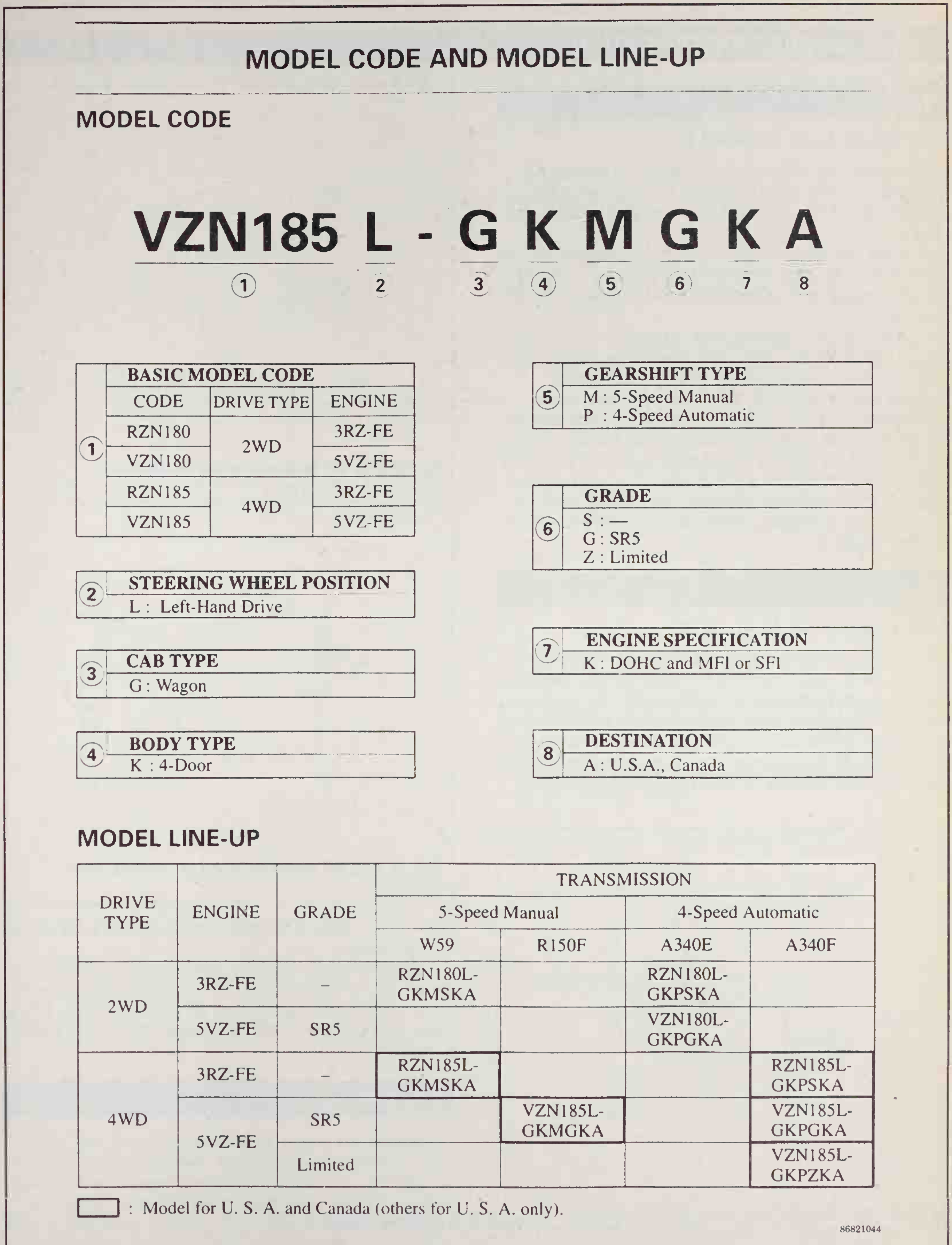
tccs1043

Fig. 31 Some specifications require the use of a torque angle meter (mechanical protractor)

MODEL IDENTIFICATION

➧ **See Figure 32**

Toyota's have a model identification plate which is located under the hood on the firewall. The models are identified by a code. These codes explain exactly what your truck is and has. For example; model number VZN170L-CRMDKAB is a 1996 Tacoma 4WD, 5 speed manual transmission, Xtracab Deluxe V-6. When you walk into a dealer or your local parts store to purchase a part for your truck, and are not sure exactly the type of vehicle you drive, the model number and vehicle identification numbers are the key.



MODEL CODE AND MODEL LINE-UP

MODEL CODE

VZN185 L - G K M G K A

VZN185	L	G	K	M	G	K	A
①	2	3	④	⑤	6	7	8

①	BASIC MODEL CODE		
	CODE	DRIVE TYPE	ENGINE
	RZN180	2WD	3RZ-FE
	VZN180		5VZ-FE
	RZN185	4WD	3RZ-FE
	VZN185		5VZ-FE

② **STEERING WHEEL POSITION**
L : Left-Hand Drive

③ **CAB TYPE**
G : Wagon

④ **BODY TYPE**
K : 4-Door

⑤ **GEARSHIFT TYPE**
M : 5-Speed Manual
P : 4-Speed Automatic

⑥ **GRADE**
S : —
G : SR5
Z : Limited

⑦ **ENGINE SPECIFICATION**
K : DOHC and MFI or SFI

⑧ **DESTINATION**
A : U.S.A., Canada

MODEL LINE-UP

DRIVE TYPE	ENGINE	GRADE	TRANSMISSION			
			5-Speed Manual		4-Speed Automatic	
			W59	R150F	A340E	A340F
2WD	3RZ-FE	–	RZN180L-GKMSKA		RZN180L-GKPSKA	
	5VZ-FE	SR5			VZN180L-GKPGKA	
4WD	3RZ-FE	–	RZN185L-GKMSKA			RZN185L-GKPSKA
	5VZ-FE	SR5		VZN185L-GKMGKA		VZN185L-GKPGKA
		Limited				VZN185L-GKPZKA

▭ : Model for U. S. A. and Canada (others for U. S. A. only).

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Fig. 32 The model code is helpful for obtaining the correct part

SERIAL NUMBER IDENTIFICATION

Vehicle

See Figures 33, 34, 35, 36 and 37

All models have the vehicle identification number stamped on a plate attached to the left side of the instrument panel. The plate is visible by looking through the windshield from the outside.

All trucks and 4Runner's also have the VIN stamped into the metal of the outer face of the right front frame rail. The number also appears on the Certification Label attached to the left door pillar.

In addition to the instrument panel number, all Land Cruisers display the VIN on the Certification Label on the left front door post. The 1991-96 Land Cruisers also have the number stamped into the outer face of the right front frame rail.

The serial number consists of a series of 17 digits including the six digit serial or production number. The first three digits are the World Manufacturer Identification number. The next five digits are the Vehicle Description Section. The remaining nine digits are the production numbers including various codes on body style, trim level (base, luxury, etc.) and safety equipment or other information.

Engine

See Figures 38, 39, 40, 41 and 42

Each engine is referred to by both its family designation, such as 22R-E, and its production or serial number. The serial number can be important when ordering parts. Certain changes may have been made during production of the engine; different parts will be required if the engine was assembled before or after the change date. Generally, parts stores and dealers list this data in their catalogs, so have the engine number handy when you go. Refer to the illustrations to determine the engine number location.

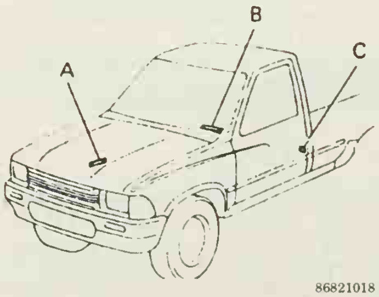

Fig. 33 The VIN locations found on Pickup trucks

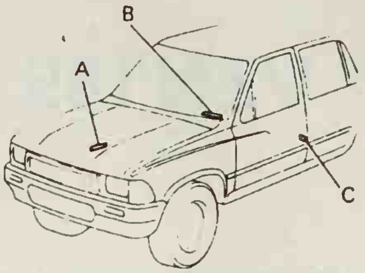

Fig. 34 The VIN locations found on 4Runners

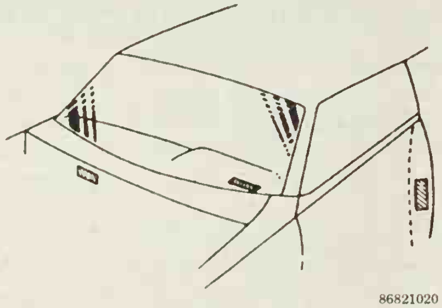

Fig. 35 The VIN locations found on 1989-90 Land Cruisers

It's a good idea to record the engine number while the vehicle is new. Jotting it inside the cover of the owner's manual or similar easy-to-find location will prevent having to scrape many years of grime off the engine when the number is finally needed.

Transmissions

Automatic and manual transmissions are used in all of the trucks excluding the Land Cruiser. The Land Cruiser only uses an automatic. The identity of the transmission is on the driver's door tag. You can also obtain the type of transmission from the model number.

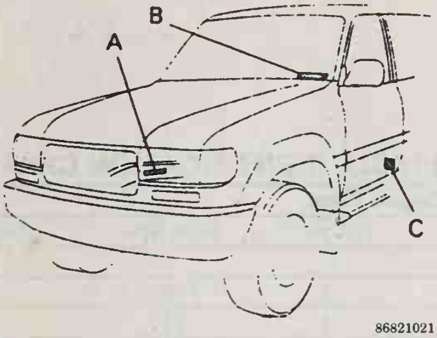
B
A
C
86821021

Fig. 36 The VIN locations for 1991-96 Land Cruisers

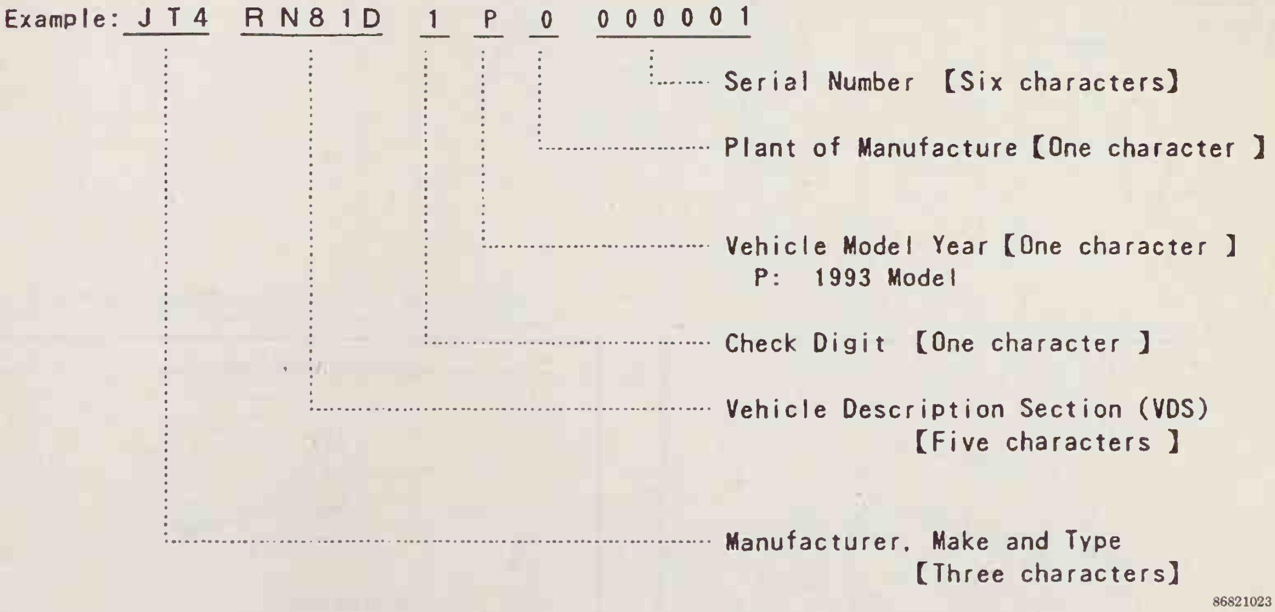
Example: JT4 RN81D 1 P 0 000001
Serial Number [Six characters]
Plant of Manufacture [One character]
Vehicle Model Year [One character]
P: 1993 Model
Check Digit [One character]
Vehicle Description Section (VDS) [Five characters]
Manufacturer, Make and Type [Three characters]
86821023

Fig. 37 The serial number on all 1989-96 models consists of a series of 17 digits

VEHICLE IDENTIFICATION CHART

Engine Code					
Code	**Liters**	**Cu. cc.**	**Cyl.**	**Fuel Sys.**	**Eng. Mfg.**
5 th digit					
R (22R)	2.4	2366	4	2 BBL	TMC
R (22R-E)	2.4	2366	4	EFI	TMC
U (2RZ-FE)	2.4	2438	4	EFI	TMC
U (3RZ-FE)	2.7	2693	4	EFI	TMC
V (3VZ-E)	3.0	2959	6	EFI	TMC
V (3VZ-FE)	3.0	2959	6	EFI	TMC
F (3F-E)	4.0	241	6	EFI	TMC
U (5VZ-FE)	3.4	3378	6	EFI	TMC
F (1FZ-FE)	4.5	4477	6	EFI	TMC
6 th digit					
L (2RZ-FE)	2.4	2366	4	EFI	TMC
N (3RZ-FE)	2.7	2693	4	EFI	TMC
M (5VZ-FE)	3.4	3378	6	EFI	TMC
J (1FZ-FE)	4.5	4477	6	EFI	TMC

Model Year	
Code	**Year**
10 th digit	
K	1989
L	1990
M	1991
N	1992
P	1993
R	1994
S	1995
T	1996

BBL - Carbureted
EFI - Electronic Fuel Injected
TMC - Toyota Motor Corporation

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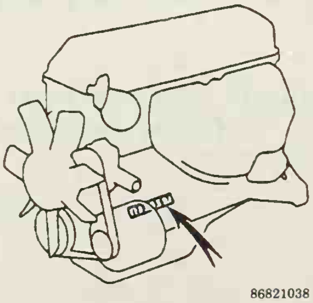

Fig. 38 Engine number location on the 22R and 22R-E engines

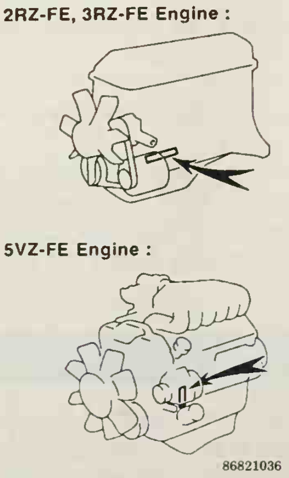

Fig. 39 Engine number location on the 2RZ-FE, 3RZ-FE and 5VZ-FE engines

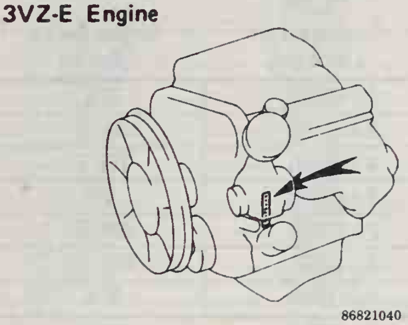
3VZ-E Engine
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Fig. 40 Engine number location on the 3VZ-E engine

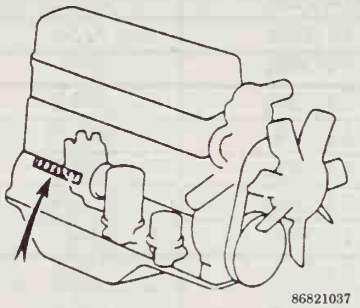

Fig. 41 Engine number location on the 3F-E engine

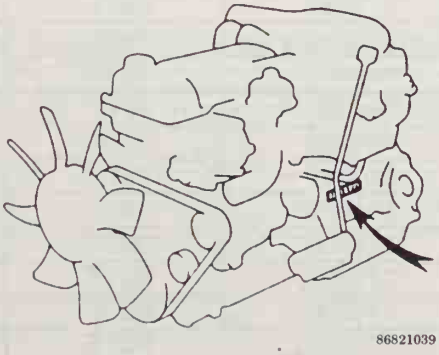

Fig. 42 Engine number location on the 1FZ-FE engine

ENGINE IDENTIFICATION

Year	Model	Engine Displacement Liters (cc)	Engine Series (ID/VIN)	Fuel System	No. of Cylinders	Engine Type
1989	4Runner	2.4 (2366)	22R	2 BBL	4	SOHC
	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R	2 BBL	4	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-FE	EFI	6	SOHC
	Land Cruiser	4.0 (3956)	3F-E	EFI	6	OHV
1990	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R	2 BBL	4	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-FE	EFI	6	SOHC
	Land Cruiser	4.0 (3956)	3F-E	EFI	6	OHV
1991	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Land Cruiser	4.0 (3956)	3F-E	EFI	6	OHV
1992	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-FE	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-FE	EFI	6	SOHC
	Land Cruiser	4.0 (3956)	3F-E	EFI	6	OHV
1993	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-E	EFI	6	SOHC
	T100	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Land Cruiser	4.5 (4477)	1FZ-FE	EFI	6	DOHC
1994	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-E	EFI	6	SOHC
	T100	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	T100	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Land Cruiser	4.5 (4477)	1FZ-FE	EFI	6	DOHC
1995	4Runner	2.4 (2366)	22R-E	EFI	4	SOHC
	4Runner	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Pick-up	2.4 (2366)	22R-E	EFI	4	SOHC
	Pick-up	3.0 (2959)	3VZ-E	EFI	6	SOHC
	Tacoma	2.4 (2438)	2RZ-FE	EFI	4	DOHC
	Tacoma	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	Tacoma	3.4 (3378)	5VZ-FE	EFI	6	DOHC
	T100	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	T100	3.4 (3378)	5VZ-FE	EFI	6	DOHC
	Land Cruiser	4.5 (4477)	1FZ-FE	EFI	6	DOHC

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ENGINE IDENTIFICATION

Year	Model	Engine Displacement Liters (cc)	Engine Series (ID/VIN)	Fuel System	No. of Cylinders	Engine Type
1996	4Runner	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	4Runner	3.4 (3378)	5VZ-FE	EFI	6	DOHC
	Tacoma	2.4 (2438)	2RZ-FE	EFI	4	DOHC
	Tacoma	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	Tacoma	3.4 (3378)	5VZ-FE	EFI	6	DOHC
	T100	2.7 (2693)	3RZ-FE	EFI	4	DOHC
	T100	3.4 (3378)	5VZ-FE	EFI	6	DOHC
	Land Cruiser	4.5 (4477)	1FZ-FE	EFI	6	DOHC

BBL - Barrel carburetor
EFI - Electronic fuel injection
SOHC - Single overhead camshaft
DOHC - Double overhead camshaft
OHV - Overhead valve

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MANUAL TRANSMISSION CHART

Transmission Type	Years	Models
G40	1989-90	Truck
G57	1989-92	Truck
G58	1989-96	Truck, 4Runner, Tacoma
W46	1989-90	Truck
W55	1989-95	Truck
W56	1989-96	Truck, 4Runner, T100
W59	1996	Tacomoa, T100
R150	1989-96	Truck, 4Runner, Tacoma
R150F	1989-96	Truck, 4Runner, Tacoma, T100

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AUTOMATIC TRANSMISSION CHART

Transmission Type	Years	Models
A43D	1989-96	Truck, Tacoma
A340E	1989-96	Truck, 4Runner, T100, Tacoma
A340F	1989-96	Truck, 4Runner
A340H	1989-95	Truck, 4Runner
A440F	1989-92	Land Cruiser
A442F	1993-95	Land Cruiser
A343F	1996	Land Cruiser

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ROUTINE MAINTENANCE

General Information

➧ See Figures 43, 44, 45, 46, 47, 48 and 49

Proper maintenance is the key to long and trouble-free vehicle life. As a conscientious owner and driver, set aside a Saturday morning, say once a month, to check or replace items which could cause major problems later. Keep your own personal log to jot down which services you performed, how much the parts cost you, the date, and the exact odometer reading at the time. Keep all receipts for such items as engine oil and filters, so that they may be referred to in case of related problems or to determine operating expenses. As a do-it-yourselfer, these receipts are the only proof you have that the required maintenance was performed. In the event of a warranty problem, these receipts will be invaluable.

The literature provided with your vehicle when it was originally delivered includes the factory recommended maintenance schedule. If you no longer have this literature, replacement copies are usually available from the dealer. A maintenance schedule is provided later in this section, in case you do not have the factory literature.

These checks and inspections can be done either by yourself a reputable shop, or the Toyota dealer.

Here are a few of the scheduled maintenance items that need to be checked frequently:

OUTSIDE THE VEHICLE

- Tire pressure — use a gauge to check the pressure
- Tire surfaces and lug nuts — check the tread depth and ensure all the lug nuts are in place
- Tire rotation — rotate every 6200 miles (1000 km)
- Fluid leaks — check the underneath for leaks of any kind
- Doors and the engine hood — check the latches ensuring they are securing properly

INSIDE THE VEHICLE

- Lights — make sure all the lights are in working order
- Reminder indicators — ensue all the warning lights and buzzers function properly
- Horn — toot the horn to make sure it works when needed
- Seats — be aware of any adjuster problems, a moving seat while you're driving is dangerous
- Seat belts — are they all working properly
- Accelerator pedal — check for smooth operation
- Clutch pedal — check for smooth operation and free-play
- Brake pedal — check for smooth operation and free-play
- Brakes — in a safe location, check for any brake pull

IN THE ENGINE COMPARTMENT

- Washer fluid — check the fluid level
- Engine coolant level — make sure the level is between the FULL and LOW marks
- Battery — if you have a maintenance battery, check the electrolyte levels
- Brake and clutch fluid levels — have the levels near the upper line of the reservoirs
- Engine oil level — with the engine **OFF**, check fluid level on the dipstick
- Power steering fluid — the level should be between HOT and COLD
- Exhaust system — visually check for cracks, holes and loose supports. Be aware of a sudden noise change in the exhaust

Along with these maintenance items, a tune-up is also part of this. A tune-up is not what it used to be years ago where you need to replace the spark plugs every 7500 miles (12,000 km). These days you can replace the plugs on some vehicles every 48,000 miles (77,000 km) or even 100,000 miles (160,900 km).

Air Filter

REMOVAL & INSTALLATION

➧ See Figures 50, 51 and 52

The air filter element should be replaced at the recommended intervals shown in the Maintenance Intervals chart

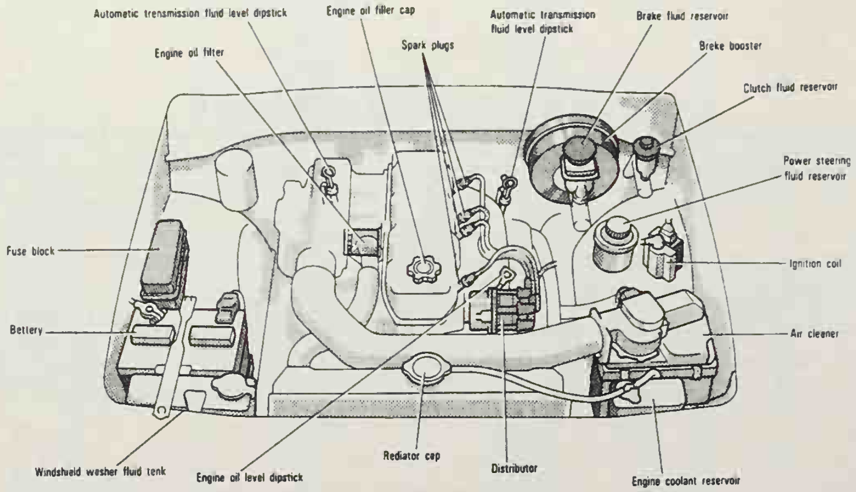
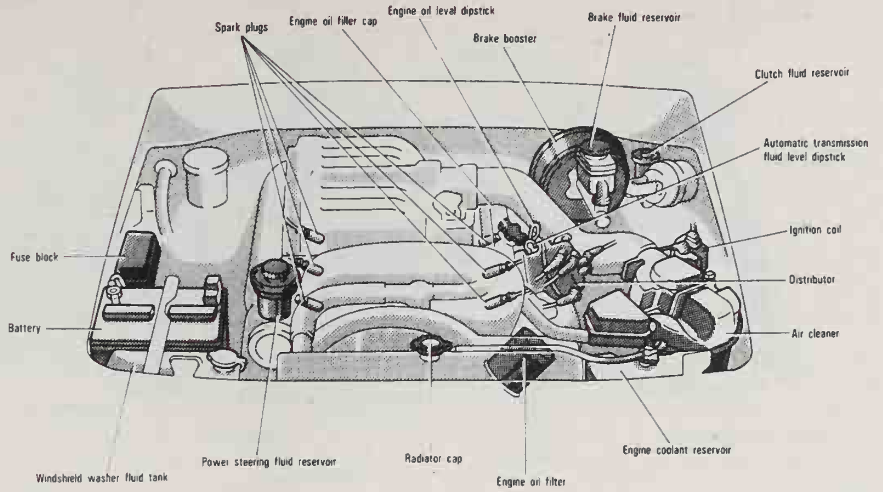
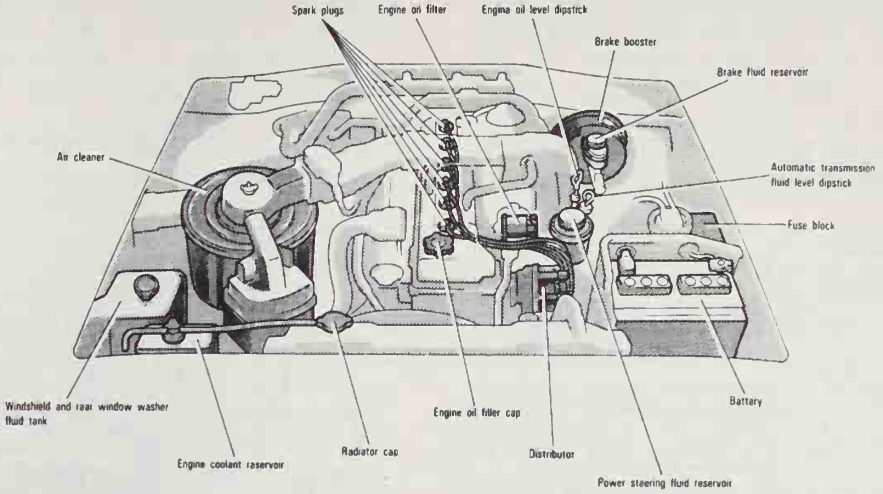

Automatic transmission fluid level dipstick
Engine oil filler cap
Automatic transmission fluid level dipstick
Brake fluid reservoir
Engine oil filter
Spark plugs
Brake booster
Clutch fluid reservoir
Power steering fluid reservoir
Fuse block
Ignition coil
Battery
Air cleaner
Windshield washer fluid tank
Engine oil level dipstick
Radiator cap
Distributor
Engine coolant reservoir
86821230

Fig. 43 View of the engine compartment maintenance components — 22R-E shown


Spark plugs
Engine oil filler cap
Engine oil level dipstick
Brake booster
Brake fluid reservoir
Clutch fluid reservoir
Automatic transmission fluid level dipstick
Ignition coil
Distributor
Air cleaner
Fuse block
Battery
Engine coolant reservoir
Windshield washer fluid tank
Power steering fluid reservoir
Radiator cap
Engine oil filter

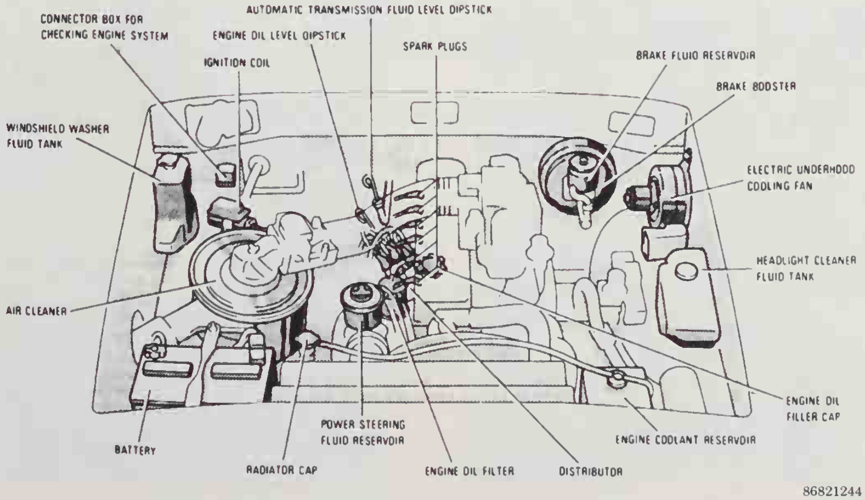
86821231

Fig. 44 View of the engine compartment maintenance components — 3VZ-E shown


Spark plugs
Engine oil filter
Engine oil level dipstick
Brake booster
Brake fluid reservoir
Air cleaner
Automatic transmission fluid level dipstick
Fuse block
Windshield and rear window washer fluid tank
Battery
Engine oil filler cap
Engine coolant reservoir
Radiator cap
Distributor
Power steering fluid reservoir

86821232

Fig. 45 View of the engine compartment maintenance components — 1FZ-FE shown


CONNECTOR BOX FOR CHECKING ENGINE SYSTEM
AUTOMATIC TRANSMISSION FLUID LEVEL DIPSTICK
ENGINE OIL LEVEL DIPSTICK
IGNITION COIL
SPARK PLUGS
BRAKE FLUID RESERVOIR
BRAKE BOOSTER
WINDSHIELD WASHER FLUID TANK
ELECTRIC UNDERHOOD COOLING FAN
HEADLIGHT CLEANER FLUID TANK
AIR CLEANER
ENGINE OIL FILLER CAP
POWER STEERING FLUID RESERVOIR
ENGINE COOLANT RESERVOIR
BATTERY
RADIATOR CAP
ENGINE OIL FILTER
DISTRIBUTOR

86821244

Fig. 46 View of the engine compartment maintenance components — 3F-E 1989-90 shown

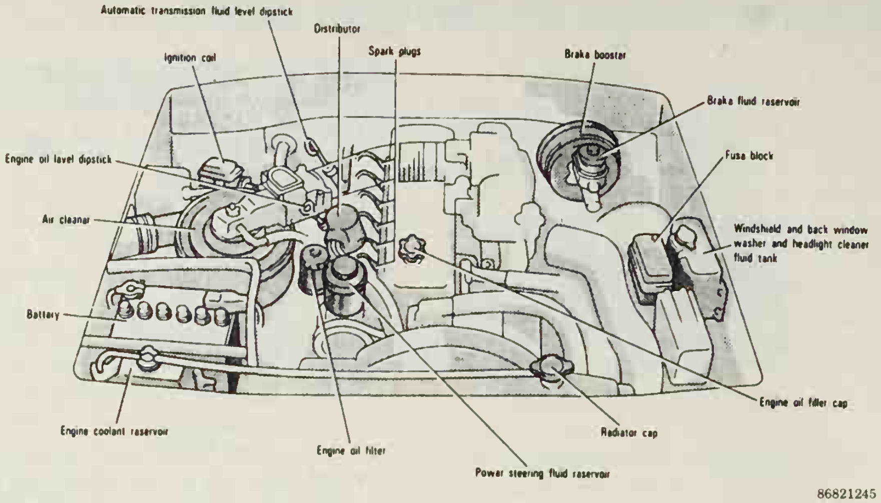

Automatic transmission fluid level dipstick
Distributor
Ignition coil
Spark plugs
Brake booster
Brake fluid reservoir
Engine oil level dipstick
Fuse block
Air cleaner
Windshield and back window washer and headlight cleaner fluid tank
Battery
Engine oil filler cap
Engine coolant reservoir
Radiator cap
Engine oil filter
Power steering fluid reservoir
86821245

Fig. 47 View of the engine compartment maintenance components — 3F-E 1991-92 shown

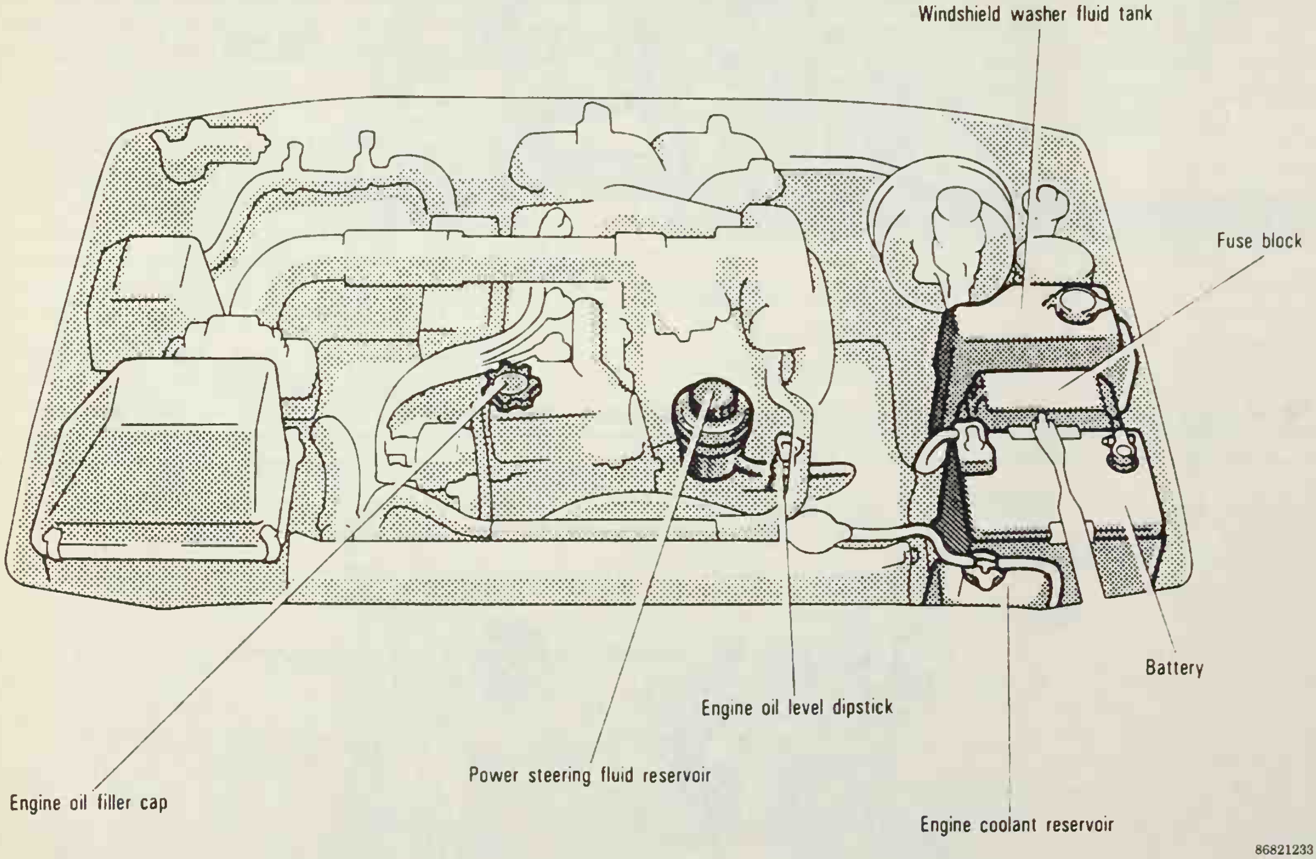

Windshield washer fluid tank
Fuse block
Battery
Engine oil level dipstick
Power steering fluid reservoir
Engine oil filler cap
Engine coolant reservoir
86821233

Fig. 48 View of the engine compartment maintenance components — 3RZ-FE shown

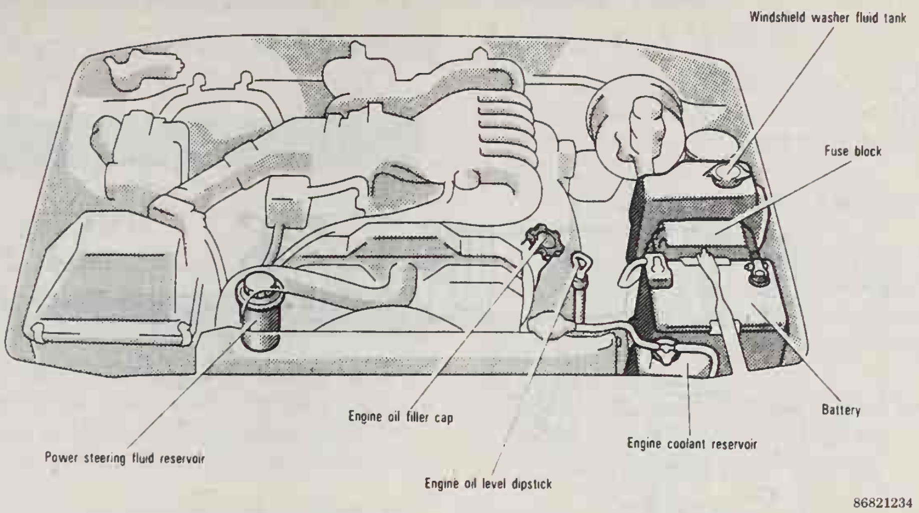

Windshield washer fluid tank
Fuse block
Battery
Engine coolant reservoir
Engine oil filler cap
Power steering fluid reservoir
Engine oil level dipstick
86821234

Fig. 49 View of the engine compartment maintenance components — 5VZ-FE shown

later in this section. If your truck is operated under severely dusty conditions or severe operating conditions, more frequent changes will certainly be necessary. Inspect the element at least twice a year. Early spring and early fall are always good times for inspection. Remove the element and check for any perforations or tears in the filter. Check the cleaner housing for signs of dirt or dust that may have leaked through the filter element or in through the snorkel tube. Shine a bright light on one side of the element and look through the filter at the light. If no glow of light can be seen through the element material, replace the filter. If holes in the filter element are apparent or signs of dirt seepage through the filter are evident, replace the filter.

1. Disconnect all hoses, ducts and vacuum tubes which would block removal of the top of the air cleaner assembly.
2. For round air cleaner housings, remove the top cover wing nut and grommet, if present. Most models will also use three or four side clips to further secure the top of the assembly. Pull the wire tab and release the clip. Remove the cover and lift out the filter element.
3. On fuel injected engines, simply release the clips holding the top of the air box and lift the lid. Note that some of these clips may be in close quarters against bodywork or other components; don't pry or force the clips.
4. Remove the filter element. Clean or replace as needed. Wipe clean all surfaces of the air cleaner housing and cover. Check the condition of the mounting gasket and replace it if it appears worn or broken.

To install:

5. Reposition the filter element in the case and install the cover, being careful not to overtighten the wingnut(s). On round-style cleaners (carbureted engines), be certain that the arrows on the cover lid and the snorkel match up properly. The lid of the air cleaner housing must be correctly installed and fit snugly. Air leaks around the top can cause air to bypass the filter and allow dirt into the engine.

➥Filter elements on fuel injected engines have a TOP and BOTTOM side, be sure they are inserted correctly.

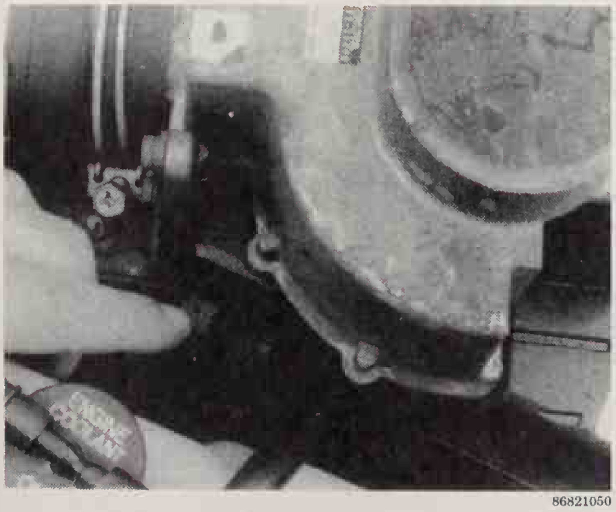


Fig. 50 Release the clips securing the lid . . .

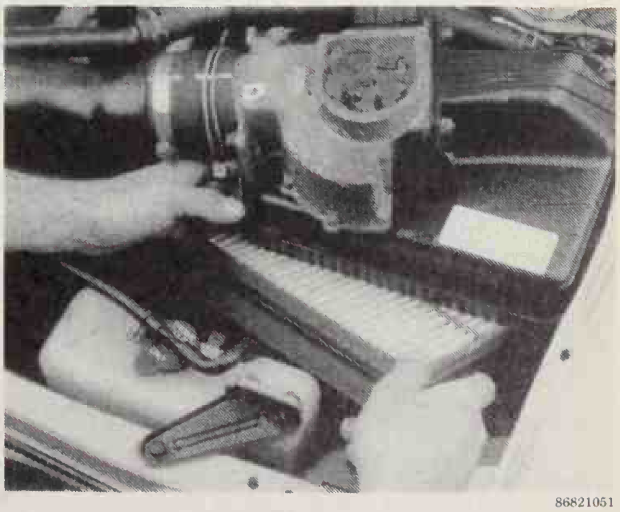


Fig. 51 . . . then lift the lid and remove the filter

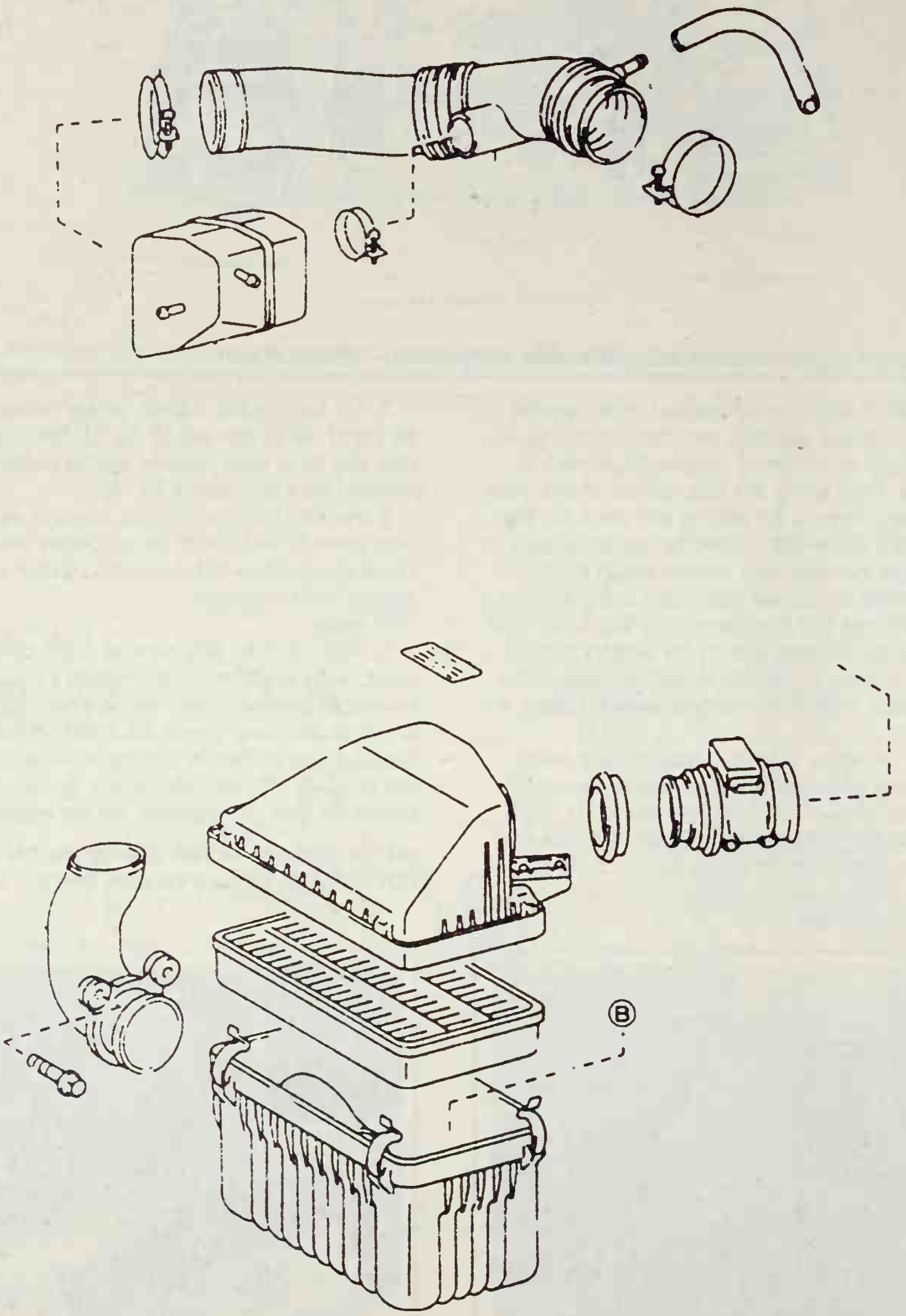


Fig. 52 Exploded view of a common air cleaner assembly found on Toyota trucks

6. Connect all hoses, duct work and vacuum lines.

➡Never operate the engine without the air filter element in place.

Fuel Filter

REMOVAL & INSTALLATION

⁂CAUTION

Never smoke when working around or near gasoline. Make sure that there are no active ignition sources (heaters, electric motors or fans, welders, anything with sparks or open flame.) in the area. Have a fire extinguisher within arm's reach at all times.

Carbureted Engines

➧ See Figure 53

The fuel filter on carbureted engines is a plastic cylinder with two ports for the fuel. It is usually located on right rear frame rail, near the fuel tank.

1. Using a pair of pliers, expand the hose clamp on one side of the filter, and slide the clamp further down the hose, past the point to which the filter pipe extends. Remove the other clamp in the same manner.
2. Grasp the hoses near the ends and twist them gently to pull them free from the filter pipe.
3. Pull the filter from the clip and discard.

To install:

4. Install the new filter into the clip. The arrow must point towards the hose that runs to the carburetor.
5. Push the hoses onto the filter pipes, then slide the clamps back into position.
6. Start the engine and check for leaks.

Fuel Injected Engines

➧ See Figures 54, 55 and 56

The fuel filters on injected engines are a metal cylinder which is located in the rear frame rail or in the engine compartment. You may find it under the injection manifold on some models. Each model varies.

1. Unbolt the retaining screws and remove the protective shield from the fuel filter.
2. Place a pan under the delivery pipe to catch the dripping fuel and SLOWLY loosen the union bolt to bleed off the fuel pressure. The fuel system is under pressure. Release pressure slowly and contain spillage. Observe "'no smoking/no open flame precautions".
3. Remove the union bolt and drain the remaining fuel.
4. Disconnect and plug the inlet line.
5. Unbolt and remove the fuel filter.

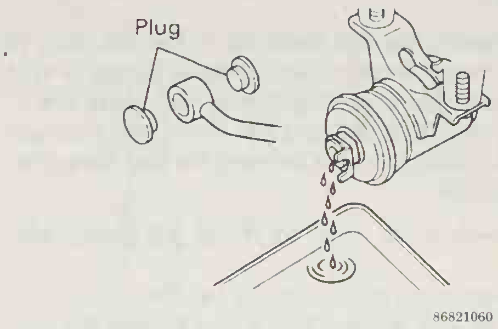


Fig. 54 Place a pan under the delivery pipe to catch the dripping fuel

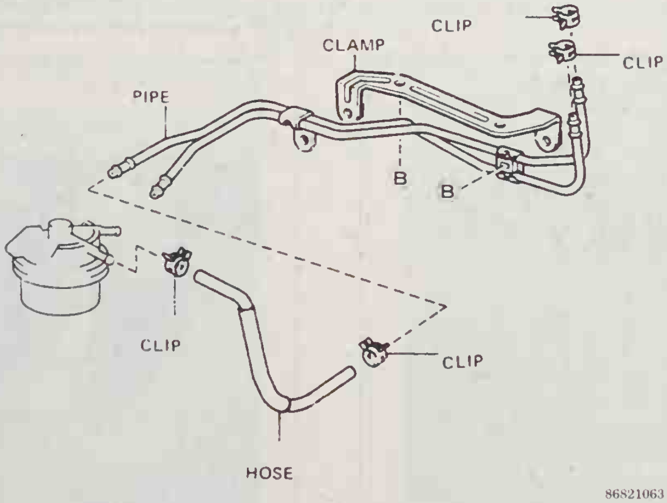


Fig. 53 Fuel filter and pipe assembly found on carbureted engines

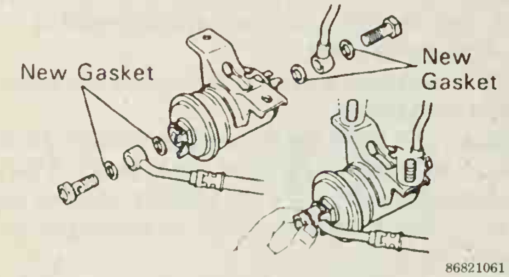


Fig. 55 Use new gaskets when reconnecting the lines

To install:

➡When tightening the fuel line bolts to the fuel filter, you must use a torque wrench. The tightening torque is very important, as under or over tightening may cause fuel leakage. Insure that there is no fuel line interference and that there is sufficient space between the fuel lines and other components.

6. Coat the flare unit, union nut and all bolt threads with engine oil.
7. Hand-tighten the inlet line to the fuel filter.
8. Install the fuel filter and then tighten the inlet line nut to 22 ft. lbs. (29 Nm).
9. Reconnect the delivery pipe using new gaskets and then tighten the union bolt to 22 ft. lbs. (29 Nm).
10. Run the engine for a short period and check for any fuel leaks.
11. Install the protective shield.

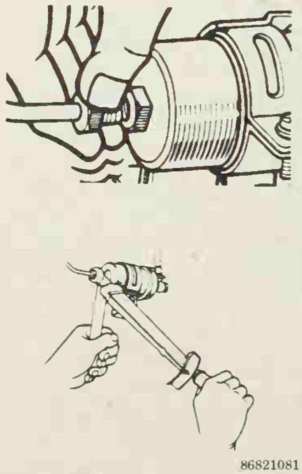


Fig. 56 Hand-tighten the fuel lines first, then final tighten with a torque wrench

Fuel Cap Gasket

REMOVAL & INSTALLATION

➧ See Figure 57

All vehicles require the replacement of the fuel filler cap gasket at 60,000 miles (96,558 km). The gasket is important in sealing the filler neck and keeping the vapors from the tank routed through the vapor emission system. On 1989 Land Cruisers the gasket is held in with 4 small screws and a retaining plate which must be removed. The later models eliminate the screws and retainer; gently pry the gasket off with your fingers or a tool. Install the new gasket and make certain it is not twisted or crimped.

PCV Valve

➧ See Figure 58

The PCV valve regulates crankcase ventilation during various engine operating conditions. At high vacuum (idle speed and partial load range) it will open slightly and at low vacuum (full throttle) it will open fully. This causes vapor to be removed from the crankcase by the engine vacuum and then sucked into the combustion chamber where it is burned along with the fuel.

➡The PCV system will not function properly unless the oil filler cap is tightly sealed. Check the gasket on the cap and be certain it is not leaking. Replace the cap or gasket or both if necessary to ensure proper sealing.

REMOVAL & INSTALLATION

➧ See Figures 59 and 60

1. Check the ventilation hoses and lines for leaks or clogging. Clean or replace as necessary.

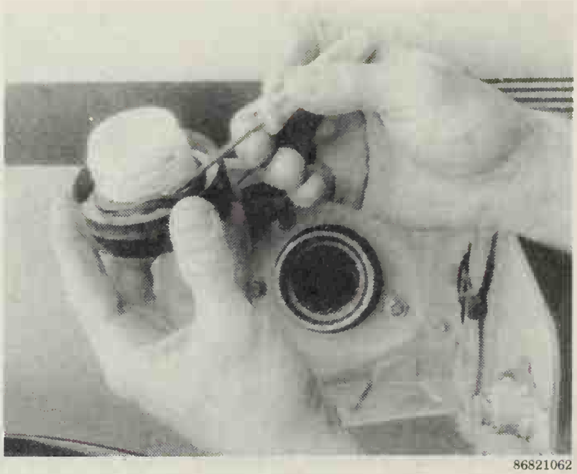


Fig. 57 A seal pick can be used to remove the cap gasket

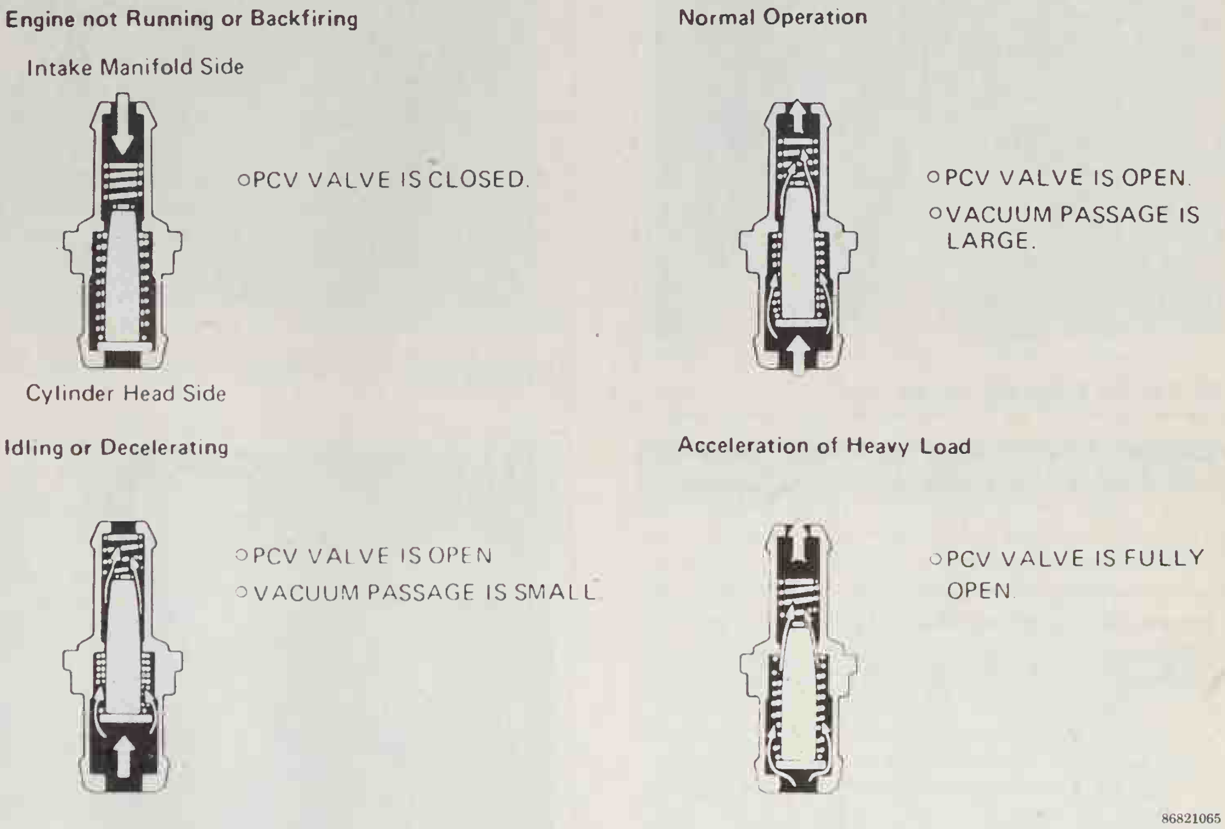

Engine not Running or Backfiring
Intake Manifold Side
○PCV VALVE IS CLOSED.
Cylinder Head Side
Normal Operation
○PCV VALVE IS OPEN.
○VACUUM PASSAGE IS LARGE.
Idling or Decelerating
○PCV VALVE IS OPEN
○VACUUM PASSAGE IS SMALL.
Acceleration of Heavy Load
○PCV VALVE IS FULLY OPEN.
86821065

Fig. 58 The PCV valve regulates crankcase ventilation according to engine running conditions

2. Locate the PCV valve in the cylinder head cover and remove it by pulling it upward.
3. Test the valve by attaching a clean tube to the crankcase end of the valve, then blow through it. There should be free passage of air through the valve.
4. Move the tube to the other end of the valve. Blow into the tube. There should be little or no passage of air through the valve.
5. If the PCV valve failed either of the preceding two checks, it will require replacement.
6. Pull the PCV valve off the hose.

To install:

7. Slip the hose back onto the proper end of the PCV valve.
8. Press the valve into the retaining grommet in the cylinder head cover.

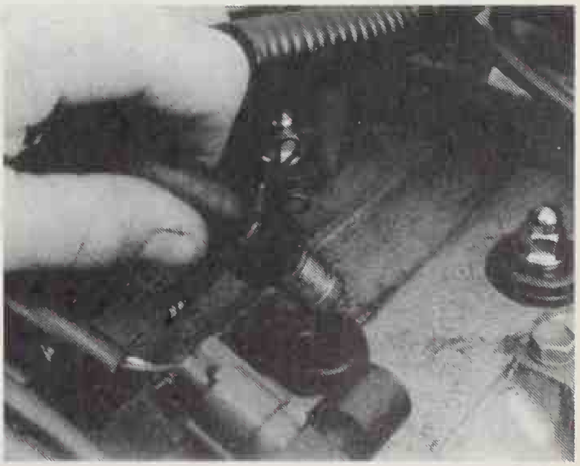


Fig. 59 Locate the PCV valve in the cylinder head cover and remove it by pulling it upward

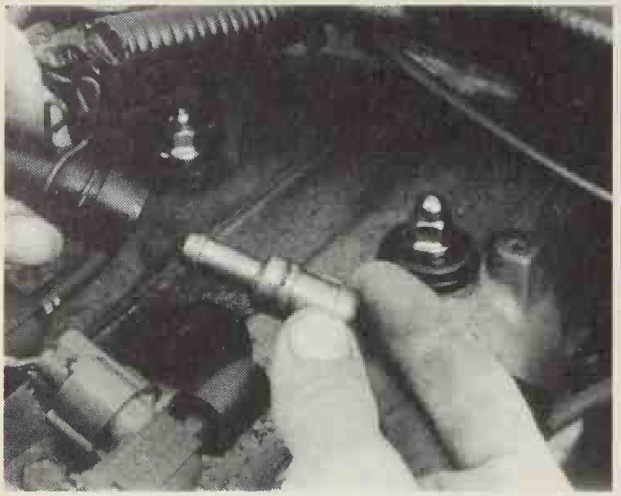


Fig. 60 Pull the PCV valve off the hose

Evaporative Canister (Charcoal Canister)

SERVICING

➧ **See Figures 61, 62, 63, 64, 65 and 66**

The canister cycles the fuel vapor from the fuel tank and, if carbureted, the carburetor float chambers into the intake manifold and eventually into the cylinders for combustion. The activated charcoal element within the canister acts as a storage device for the fuel vapors at times when the engine operating conditions do not allow efficient burning of the vapors.

The only required service for the canister is inspection at the intervals specified in the Maintenance Chart at the end of this section. If the charcoal element is saturated (possibly from carburetor flooding), the entire canister will require replacement. Label and disconnect the canister purge hoses, loosen the retaining bracket bolt(s) and lift out the canister. Installation is simply the reverse of the removal process. To check the canister:

1. Label the vacuum lines leading to the canister.
2. Remove the vacuum lines attached to the canister.
3. Unfasten the retaining bolts from the canister.
4. Lift the canister up and remove the lower hose attached to the unit.
5. Inspect the case for any cracking or damage.
6. Using low pressure compressed air, blow into the tank pipe (flanged end) and check that air flows freely from the other ports.
7. Blow into the purge pipe (next to tank pipe) and check that air does not flow from the other ports. If air does flow, the check valve has failed and the canister must be replaced.
8. Never attempt to flush the canister with fluid or solvent. Low pressure air 43 psi (294 kPa) maximum may be used to evaporate any vapors within the canister. When applying the air, hold a finger over the purge pipe to force all the air out the bottom port.

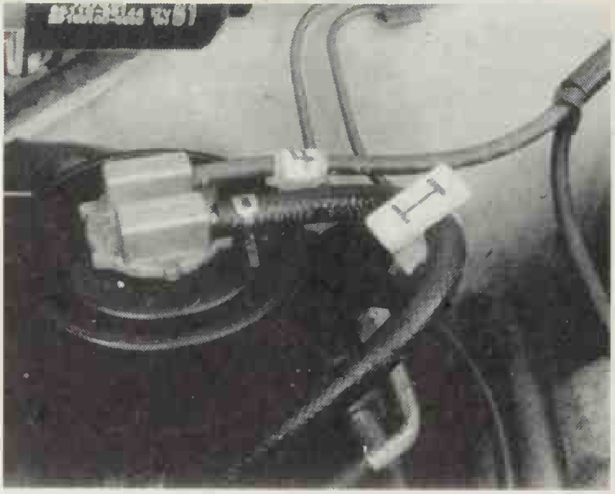


Fig. 62 Label the vacuum lines leading to the canister

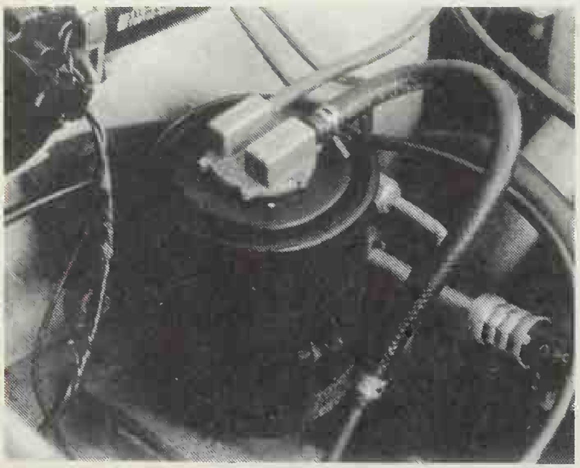


Fig. 61 The evaporative canister also known as the charcoal canister

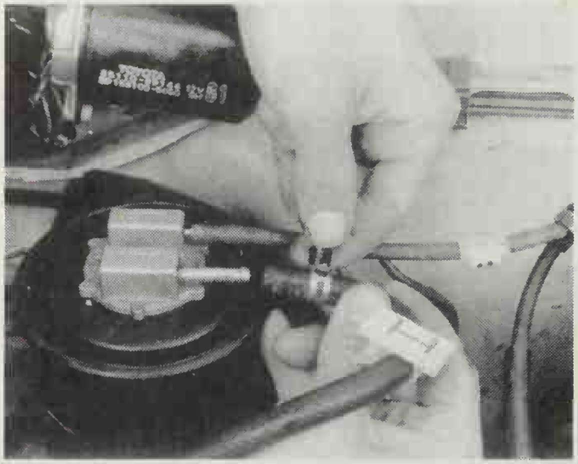


Fig. 63 Remove the vacuum lines attached to the canister

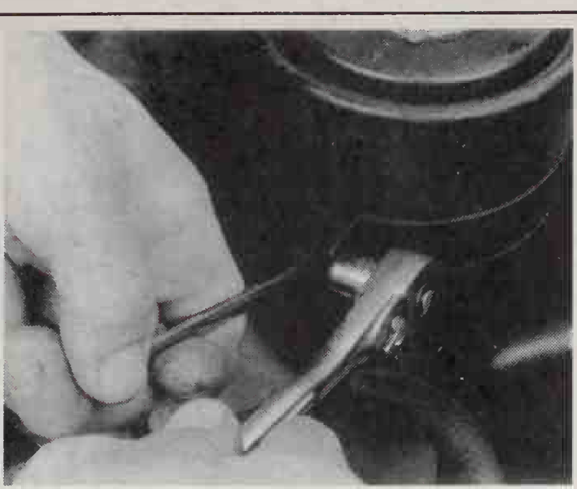

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Fig. 64 Unfasten the retaining bolts from the canister . . .

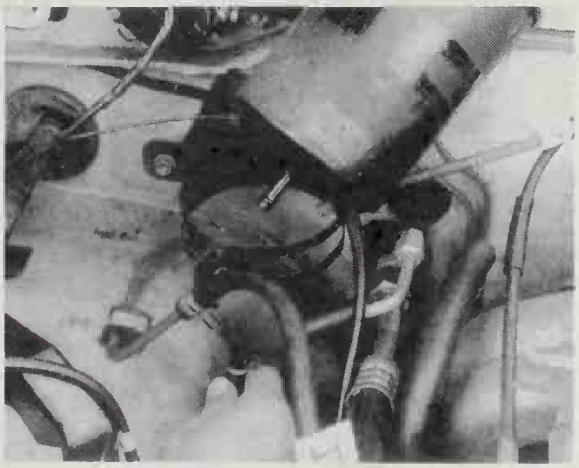
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Fig. 65 . . . then lift the canister up and remove the lower hose attached to the unit

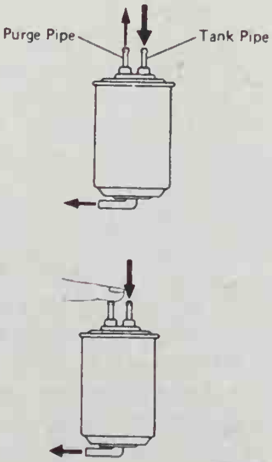

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Fig. 66 When applying the air, hold a finger over the purge pipe to force all the air out the bottom port

9. No carbon should come out of the filter at any time. Loose charcoal is a sign of internal failure in the canister.

Battery

GENERAL MAINTENANCE

All batteries, regardless of type, should be carefully secured by a battery hold-down device. If this is not done, the battery terminals or casing may crack from stress applied to the battery during vehicle operation. A battery which is not secured may allow acid to leak out, making it discharge faster; such leaking corrosive acid can also eat away components under the hood. A battery that is not sealed must be checked periodically for electrolyte level. You cannot add water to a sealed maintenance-free battery (though not all maintenance-free batteries are sealed), but a sealed battery must also be checked for proper electrolyte level as indicated by the color of the built-in hydrometer "eye."

Keep the top of the battery clean, as a film of dirt can completely discharge a battery that is not used for long periods. A solution of baking soda and water may be used for cleaning, but be careful to flush this off with clear water. DO NOT let any of the solution into the filler holes. Baking soda neutralizes battery acid and will de-activate a battery cell.

⁂CAUTION

Always use caution when working on or near the battery. Never allow a tool to bridge the gap between the negative and positive battery terminals. Also, be careful not to allow a tool to provide a ground between the positive cable/terminal and any metal component on the vehicle. Either of these conditions will cause a short circuit leading to sparks and possible personal injury.

Batteries in vehicles which are not operated on a regular basis can fall victim to parasitic loads (small current drains which are constantly drawing current from the battery). Normal parasitic loads may drain a battery on a vehicle that is in storage and not used for 6-8 weeks. Vehicles that have additional accessories such as a cellular phone, an alarm system or other devices that increase parasitic load may discharge a battery sooner. If the vehicle is to be stored for 6-8 weeks in a secure area and the alarm system, if present, is not necessary, the negative battery cable should be disconnected at the onset of storage to protect the battery charge.

Remember that constantly discharging and recharging will shorten battery life. Take care not to allow a battery to be needlessly discharged.

BATTERY FLUID

➧ See Figures 67, 68 and 69

✻✻CAUTION

Battery electrolyte contains sulfuric acid. If you should splash any on your skin or in your eyes, flush the affected area with plenty of clear water. If it lands in your eyes, get medical help immediately.

The fluid (sulfuric acid solution) contained in the battery cells will tell you many things about the condition of the battery. Because the cell plates must be kept submerged below the fluid level in order to operate, maintaining the fluid level is extremely important. And, because the specific gravity of the acid is an indication of electrical charge, testing the fluid can be an aid in determining if the battery must be replaced. A battery in a vehicle with a properly operating charging system should require little maintenance, but careful, periodic inspection should reveal problems before they leave you stranded.

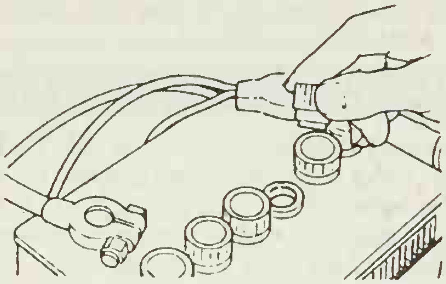
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Fig. 67 On non-maintenance free batteries, the level can be checked through the case on translucent batteries; the cell caps must be removed on other models

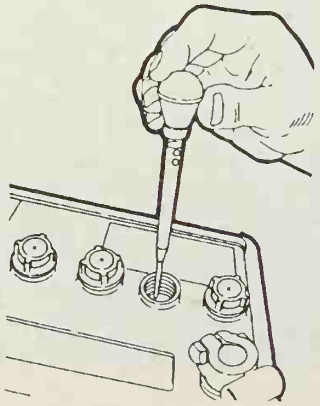
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Fig. 68 Check the specific gravity of the battery's electrolyte with a hydrometer

Fluid Level

Check the battery electrolyte level at least once a month, or more often in hot weather or during periods of extended vehicle operation. On non-sealed batteries, the level can be checked either through the case on translucent batteries or by removing the cell caps on opaque-cased types. The electrolyte level in each cell should be kept filled to the split ring inside each cell, or the line marked on the outside of the case.

If the level is low, add only distilled water through the opening until the level is correct. Each cell is separate from the others, so each must be checked and filled individually. Distilled water should be used, because the chemicals and minerals found in most drinking water are harmful to the battery and could significantly shorten its life.

If water is added in freezing weather, the vehicle should be driven several miles to allow the water to mix with the electrolyte. Otherwise, the battery could freeze.

Although some maintenance-free batteries have removable cell caps for access to the electrolyte, the electrolyte condition and level on all sealed maintenance-free batteries must be checked using the built-in hydrometer "eye." The exact type of eye varies between battery manufacturers, but most apply a sticker to the battery itself explaining the possible readings. When in doubt, refer to the battery manufacturer's instructions to interpret battery condition using the built-in hydrometer.

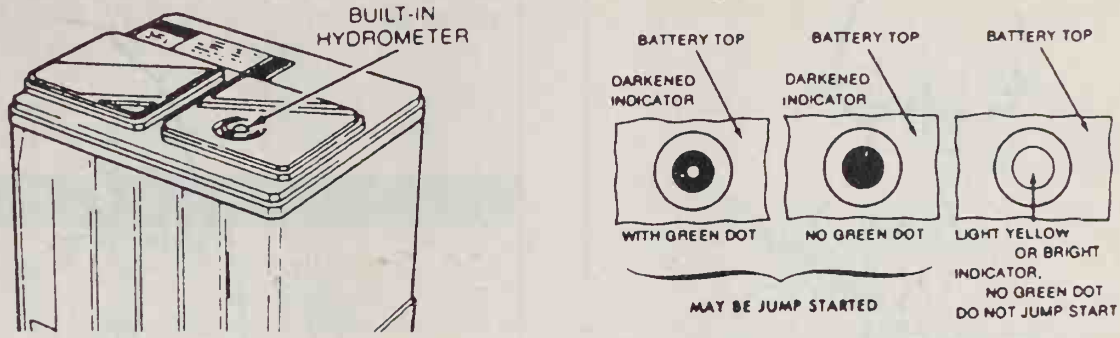
➡Although the readings from built-in hydrometers found in sealed batteries may vary, a green eye usually indicates a properly charged battery with sufficient fluid level. A dark eye is normally an indicator of a battery with sufficient fluid, but one which may be low in charge. And a light or yellow eye is usually an indication that electrolyte supply has dropped below the necessary level for battery (and hydrometer) operation. In this last case, sealed batteries with an insufficient electrolyte level must usually be discarded.

Specific Gravity

As stated earlier, the specific gravity of a battery's electrolyte level can be used as an indication of battery charge. At least once a year, check the specific gravity of the battery. It should be between 1.20 and 1.26 on the gravity scale. Most auto supply stores carry a variety of inexpensive battery testing hydrometers. These can be used on any non-sealed battery to test the specific gravity in each cell.

The battery testing hydrometer has a squeeze bulb at one end and a nozzle at the other. Battery electrolyte is sucked into the hydrometer until the float is lifted from its seat. The specific gravity is then read by noting the position of the float. If gravity is low in one or more cells, the battery should be slowly charged and checked again to see if the gravity has come up. Generally, if after charging, the specific gravity between any two cells varies more than 50 points (0.50), the battery should be replaced as it can no longer produce sufficient voltage to guarantee proper operation.

On sealed batteries, the built-in hydrometer is the only way of checking specific gravity. Again, check with your battery's manufacturer for proper interpretation of its built-in hydrometer readings.


BUILT-IN
HYDROMETER
BATTERY TOP
BATTERY TOP
BATTERY TOP
DARKENED
INDICATOR
DARKENED
INDICATOR
WITH GREEN DOT
NO GREEN DOT
LIGHT YELLOW
OR BRIGHT
INDICATOR,
NO GREEN DOT
DO NOT JUMP START
MAY BE JUMP STARTED

Location of Indicator on sealed battery

Check the appearance of the charge indicator on top of the battery before attempting a jump start; if it's not green or dark, do not jump start the car

tccs1253

Fig. 69 A typical sealed (maintenance-free) battery with a built-in hydrometer — NOTE that the hydrometer eye may vary between battery manufacturers; always refer to the battery's label

CABLES

➧ See Figures 70, 71, 72, 73, 74 and 75

Once a year (or as necessary), the battery terminals and the cable clamps should be cleaned. Loosen the clamps and remove the cables, negative cable first. On batteries with posts on top, the use of a puller specially made for this purpose is recommended. These are inexpensive and available in most auto parts stores. Side terminal battery cables are secured with a small bolt.

Clean the cable clamps and the battery terminal with a wire brush, until all corrosion, grease, etc., is removed and the metal is shiny. It is especially important to clean the inside of the clamp (an old knife is useful here) thoroughly, since a small deposit of foreign material or oxidation there will prevent a sound electrical connection and inhibit either starting or charging. Special tools are available for cleaning these parts, one type for conventional top post batteries and another type for side terminal batteries.

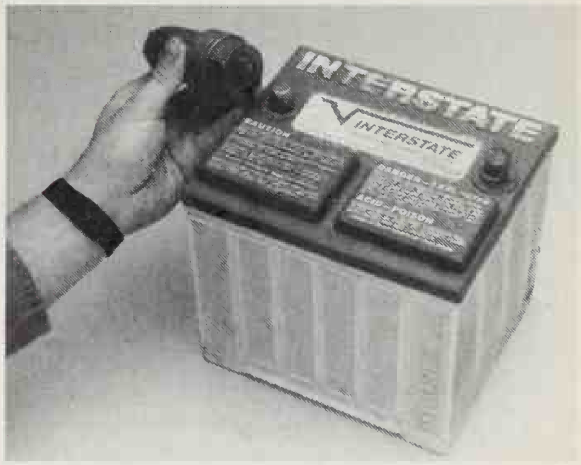


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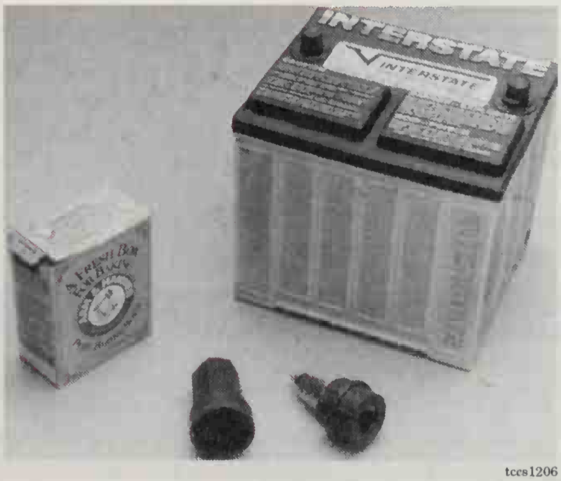
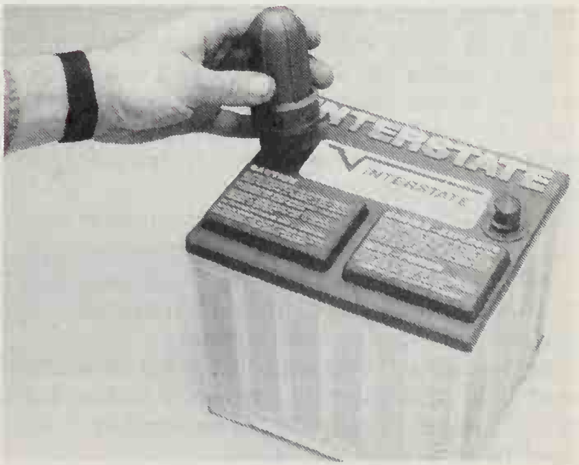
Fig. 71 The underside of this special battery tool has a wire brush to clean post terminals



tccs1206

Fig. 70 Maintenance is performed with household items and with special tools like this post cleaner



tccs1208

Fig. 72 Place the tool over the terminals and twist to clean the post

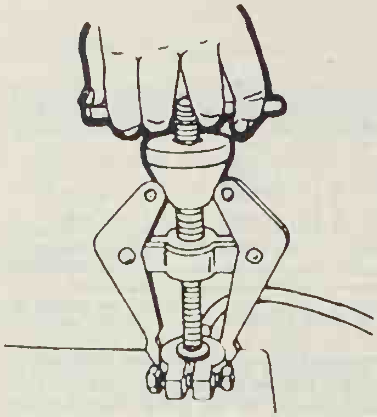


Fig. 73 A special tool is available to pull the clamp from the post

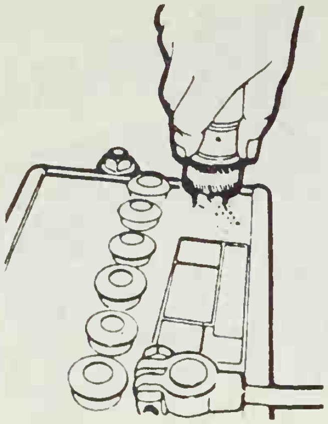


Fig. 74 Clean the battery terminals until the metal is shiny

Before installing the cables, loosen the battery hold-down clamp or strap, remove the battery and check the battery tray. Clear it of any debris, and check it for soundness (the battery tray can be cleaned with a baking soda and water solution). Rust should be wire brushed away, and the metal given a couple coats of anti-rust paint. Install the battery and tighten the hold-down clamp or strap securely. Do not overtighten, as this can crack the battery case.

After the clamps and terminals are clean, reinstall the cables, negative cable last; DO NOT hammer the clamps onto post batteries. Tighten the clamps securely, but do not distort them. Give the clamps and terminals a thin external coating of grease after installation, to retard corrosion.

Check the cables at the same time that the terminals are cleaned. If the cable insulation is cracked or broken, or if the ends are frayed, the cable should be replaced with a new cable of the same length and gauge.

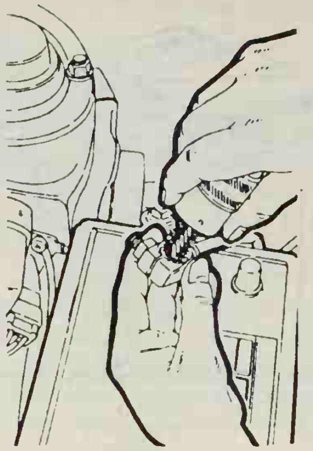


Fig. 75 The cable ends should be cleaned as well

CHARGING

✻✻CAUTION

The chemical reaction which takes place in all batteries generates explosive hydrogen gas. A spark can cause the battery to explode and splash acid. To avoid serious personal injury, be sure there is proper ventilation and take appropriate fire safety precautions when connecting, disconnecting, or charging a battery and when using jumper cables.

A battery should be charged at a slow rate to keep the plates inside from getting too hot. However, if some maintenance-free batteries are allowed to discharge until they are almost "dead," they may have to be charged at a high rate to bring them back to "life." Always follow the charger manufacturer's instructions on charging the battery.

REPLACEMENT

When it becomes necessary to replace the battery, select one with a rating equal to or greater than the battery originally installed. Deterioration and just plain aging of the battery cables, starter motor, and associated wires makes the battery's job harder in successive years. The slow increase in electrical resistance over time makes it prudent to install a new battery with a greater capacity than the old.

Heat Insulator

SERVICING

▶ See Figure 76

The or heat insulator is the covering over the exhaust manifold and is secured by three or four bolts. Remove the O_2 sensor electrical connection if equipped. Unfasten the bolts securing the insulator to the manifold. Remove any gasket material and check the insulator for leaks, cracks or corrosion. Install a new gasket to the manifold, then attach the insulator. Tighten the mounting bolts as follows:

- 5VZ-FE engines — 71 inch lbs. (8 Nm)
- 2RZ-FE and 3RZ-FE engines — 48 inch lbs. (6 Nm)
- 22R-E and 1FZ-FE engines — 14 ft. lbs. (19 Nm)

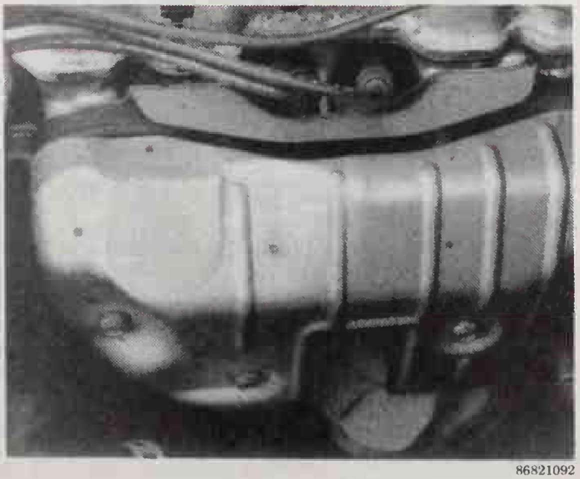


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Fig. 76 The heat insulator is the covering over the exhaust manifold and is secured by three or four bolts

Belts

INSPECTION

➧ See **Figures 77, 78, 79, 80 and 81**

Check the condition of the drive belts and check the belt tension at least every 15,000 miles (24,000 km). Inspect the belts for signs of glazing or cracking. A glazed belt will be perfectly smooth from slippage, while a good belt will have a slight texture of fabric visible. Cracks will generally start at the inner edge of the belt and run outward. Replace the belt at the first sign of cracking or if the glazing is severe.

Belt tension does not refer to play or droop. By placing your thumb midway between the two pulleys, it should be possible to depress the belt ¼-½ in. (6-13mm). If any of the belts can be depressed more than this, or cannot be depressed this much, adjust the tension. While this is an inaccurate test, it provides a quick reference. Inadequate tension will always result in slippage or wear, while excessive tension will damage pulley bearings and cause belts to fray and crack. A belt should be just tight enough to perform without slipping or squealing.

Its not a bad idea to replace all drive belts at 60,000 miles (96,000 km) regardless of their condition.

ADJUSTMENT

➧ See **Figure 82**

Toyota measures belt tension in pounds of force as determined by a belt tension tester. The Nippondenso and Bur-

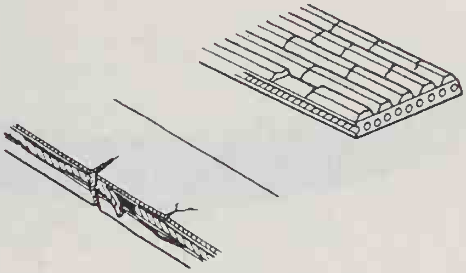

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Fig. 77 Their are two types of drive belts, ribbed and non-ribbed

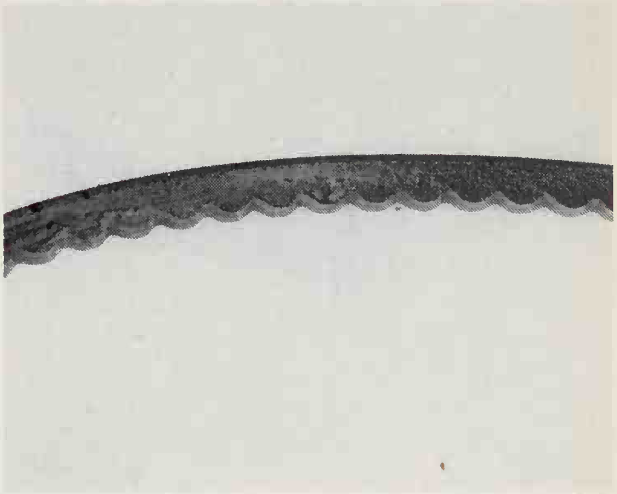

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Fig. 78 An example of a healthy drive belt

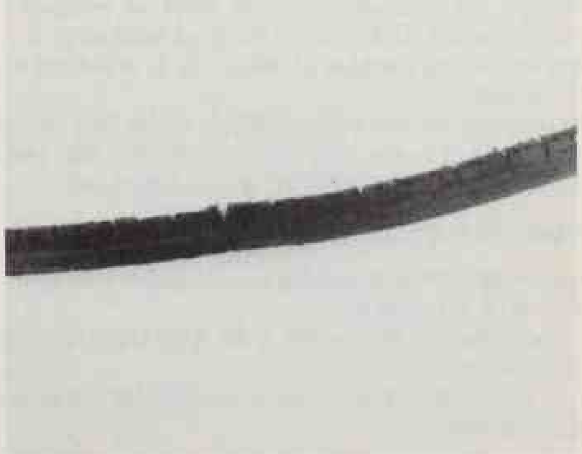

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Fig. 79 The deep cracks in this belt will cause it to flex, causing heat that will eventually lead to failure

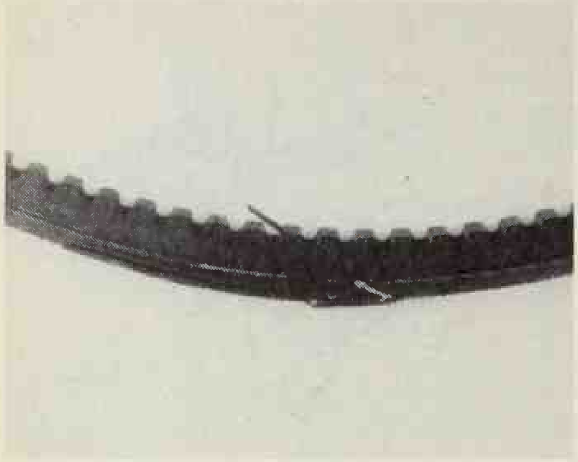

Fig. 80 The cover of this belt is worn exposing the critical reinforcing cords to excessive wear

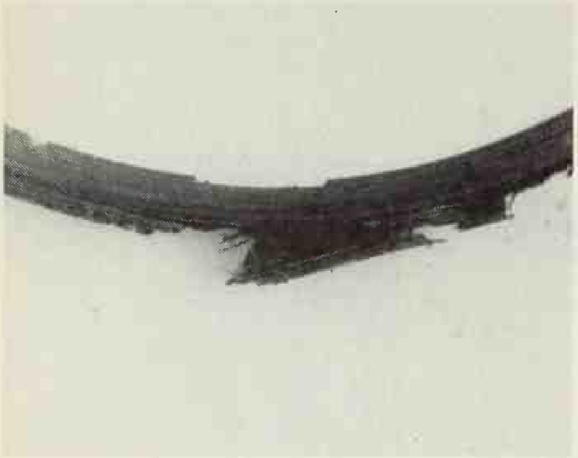

Fig. 81 Too wide a belt on a narrow pulley can groove belt's side as well as damage the cover and seat

roughs testers are available through dealers or may be found at retail auto parts stores. The tester slips over a short section of the drive belt, and, when tightened, reads the deflection pressure on a dial. This is one of the most exact ways of setting tension and purchase of this tool or its equivalent is recommended.

Specifications for new belts are slightly higher than for used belts. A new belt is one which has not been run under tension for more than 5 minutes. Anything else is a used belt.

22R and 22R-E Engines

- Alternator with air pump: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)
- Power Steering: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)
- Air Conditioning: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)

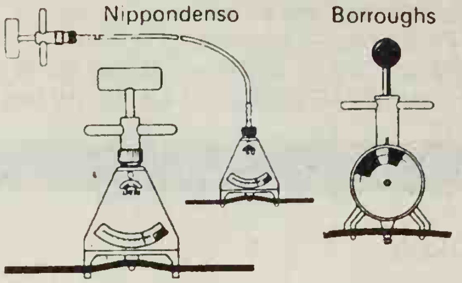

Fig. 82 The Nippondenso and Burroughs testers are available through dealers or may be found at retail auto parts stores

3VZ-E Engine

- Alternator: New — 160 ft. lbs. (217 Nm) Used — 100 ft. lbs. (136 Nm)
- Power Steering: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)
- Air Conditioning: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)

5VZ-E Engine

- Alternator: New — 160 ft. lbs. (217 Nm) Used — 100 ft. lbs. (136 Nm)
- Power Steering: New — 158 ft. lbs. (214 Nm) Used — 103 ft. lbs. (140 Nm)
- Air Conditioning: New — 160 ft. lbs. (217 Nm) Used — 100 ft. lbs. (136 Nm)

2RZ-FE and 3RZ-FE Engines

- Alternator: New — 165 ft. lbs. (224 Nm) Used — 115 ft. lbs. (156 Nm)
- Power Steering: New — 158 ft. lbs. (214 Nm) Used — 103 ft. lbs. (140 Nm)
- Air Conditioning: New — 160 ft. lbs. (217 Nm) Used — 100 ft. lbs. (136 Nm)

3F-E Engine

- Alternator: New — 145 ft. lbs. (196 Nm) Used — 100 ft. lbs. (136 Nm)
- Power Steering and air pump: New — 145 ft. lbs. (196 Nm) Used — 100 ft. lbs. (136 Nm)
- Air conditioning: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)

1FZ-FE Engine

- Alternator: New — 110 ft. lbs. (149 Nm) Used — 67 ft. lbs. (91 Nm)
- Air Conditioning: New — 125 ft. lbs. (169 Nm) Used — 80 ft. lbs. (108 Nm)

REMOVAL & INSTALLATION

See Figures 83, 84, 85, 86, 87 and 88

When buying replacement belts, remember that the fit is critical according to the length of the belt ("diameter"), the width of the belt, the depth of the belt and the angle or profile of the V shape. The belt shape should exactly match the shape of the pulley; belts that are not an exact match can cause noise, slippage and premature failure.

If a belt must be replaced, the driven unit must be loosened and moved to its extreme loosest position, generally by moving it toward the center of the motor. After removing the old belt, check the pulleys for dirt or built-up material which could affect belt contact. Carefully install the new belt, remembering that it is new and unused-it may appear to be just a little too small to fit over the pulley flanges.

Fit the belt over the largest pulley (usually the crankshaft pulley at the bottom center of the motor) first, then work on the smaller one(s). Gentle pressure in the direction of rotation is helpful. Some belts run around a third or idler pulley, which acts as an additional pivot in the belt's path. It may be possible to loosen the idler pulley as well as the main component, making your job much easier. Depending on which belt(s) you are changing, it may be necessary to loosen or remove other interfering belts to get at the one(s) you want.

After the new belt is installed, draw tension on it by moving the driven unit away from the motor and tighten its mounting bolts. This is sometimes a three or four-handed job; you may find an assistant helpful. Make sure that all the bolts you loosened get re-tightened and that any other loosened belts also have the correct tension. A new belt can be expected to stretch a bit after installation so be prepared to re-adjust your new belt, if needed, within the first hundred miles/kilometers of use.

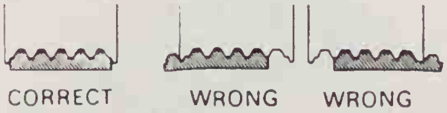

Fig. 83 When installing a new or used belt, make certain the belt is installed in the grooves correctly

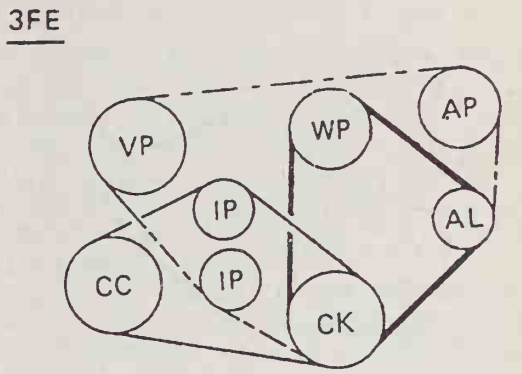

Fig. 85 Belt routings on the 3-FE engine

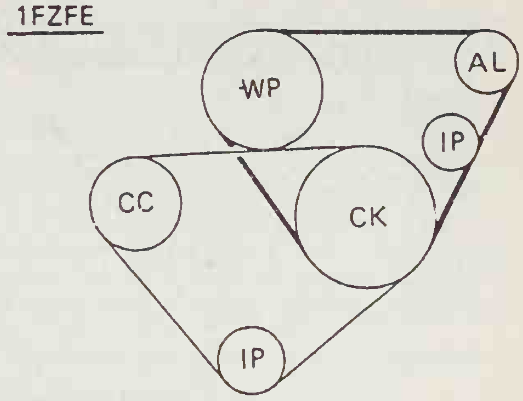

Fig. 86 Belt routings on the 1FZ-FE engine

VP : Vane Pump
AL : Alternator
CK : Crankshaft
CC : Cooler Compressor
IP : Idle Pulley
WP : Water Pump
AP : Air Pump

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Fig. 84 Listing of pulley abbreviations

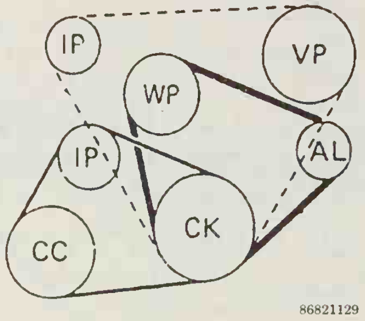

Fig. 87 Belt routings on the 3RZ-FE engine

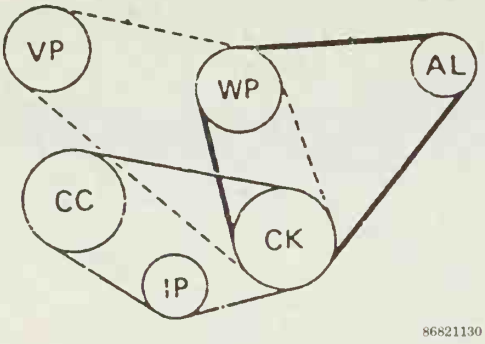

Fig. 88 Belt routings on the 3VZ-FE and 5VZ-FE engines

Timing Belts

INSPECTION

➧ **See Figures 89, 90, 91, 92, 93 and 94**

Toyota recommends that the timing belt be replaced on vehicles that are used in extensive idling or low speed driving for long distances. Police, taxi and door-to-door deliveries are commonly used in this manner. The timing belt should be replaced every 60,000 miles (96,000 km) in these cases. Toyota trucks do not have interference engines; where engine damage will occur if the belt snaps. If your vehicle has high milage, you may want to consider replacing the belt to prevent the possibility of having it snap. Or if your engine is being overhauled, inspect the belt for wear and replace if needed. In the event the belt does snap while you are driving, turn the engine **OFF** immediately. Section 3 has removal and installation procedures available.

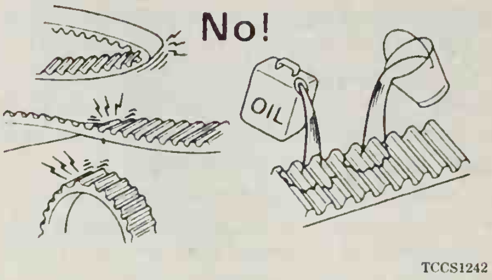

Fig. 89 Do not bend, twist or turn the timing belt inside out. Never allow oil, water or steam to contact the belt

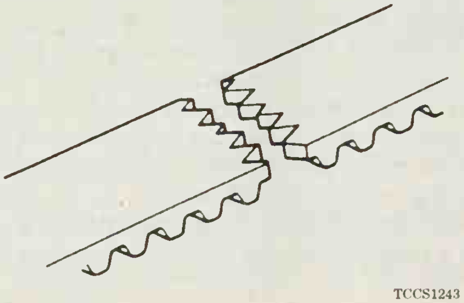

Fig. 90 Check for premature parting of the belt

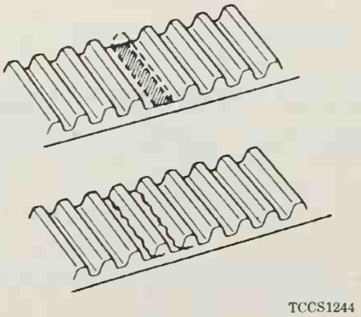

Fig. 91 Check the if the teeth are cracked or damaged

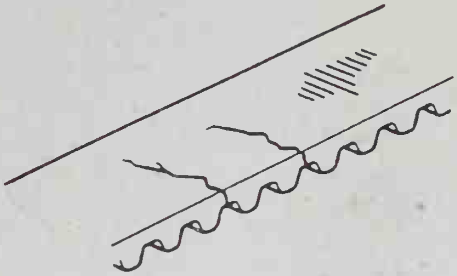

Fig. 92 Look for noticeable cracks or wear on the belt face

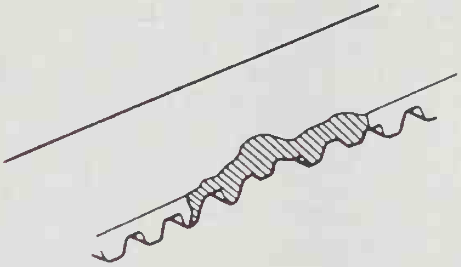

Fig. 93 You may only have damage on one side of the belt, the guide could be the culprit

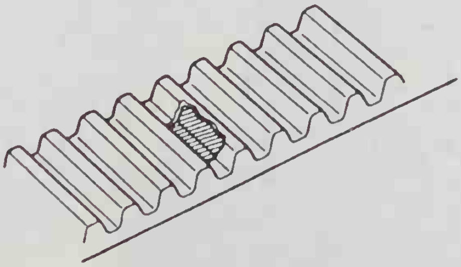

Fig. 94 Foreign materials can get in between the teeth and cause damage

Hoses

➧ **See Figures 95, 96, 97 and 98**

Upper and lower radiator hoses along with the heater hoses should be checked for deterioration, leaks and loose hose clamps at least every 15,000 miles (24,000 km). It is also wise to check the hoses periodically in early spring and at the beginning of the fall or winter when you are performing other maintenance. A quick visual inspection could discover a weakened hose which might have left you stranded if it had remained unrepaired.

Whenever you are checking the hoses, make sure the engine and cooling system is cold. Visually inspect for cracking, rotting or collapsed hoses, replace as necessary. Run your hand along the length of the hose. If a weak or swollen spot is noted when squeezing the hose wall, the hose should be replaced.

REMOVAL & INSTALLATION

➧ **See Figures 99, 100, 101, 102, 103 and 104**

⁂CAUTION

Never remove the pressure cap while the engine is running or personal injury from scalding hot coolant or steam may result. If possible, wait until the engine has cooled to remove the pressure cap. If this is not possible, wrap a thick cloth around the pressure cap and turn it slowly to the stop. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, still using the cloth, turn and remove the cap.

1. Remove the radiator pressure cap.
2. Position a clean container under the radiator and/or engine petcock or plug, then open the drain and allow the cooling system to drain to an appropriate level. For some upper hoses only a little coolant must be drained. To remove hoses

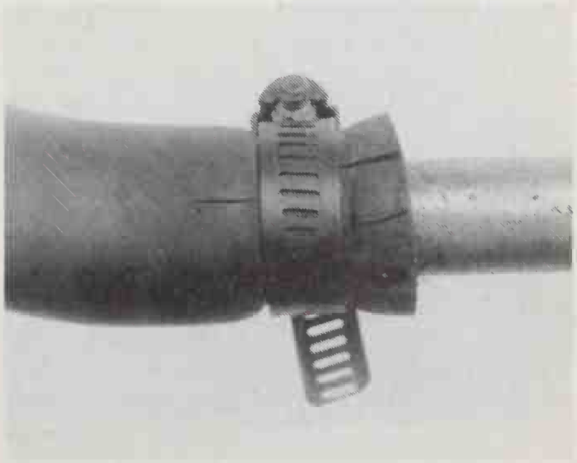

Fig. 95 The cracks developing along this hose are a result of age and hardening

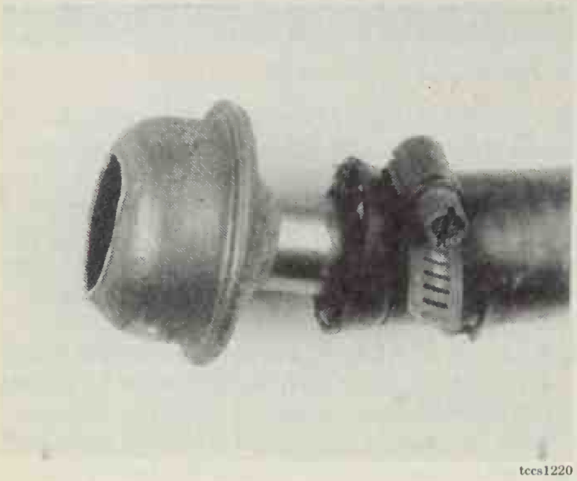

Fig. 96 A hose clamp that is too tight can cause older hoses to separate and tear

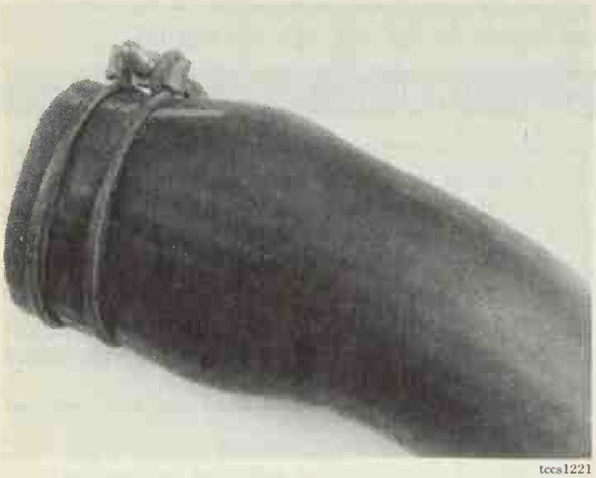

Fig. 97 Check for soft, spongy hoses like this is (swollen at the clamp) — this hose will eventually burst

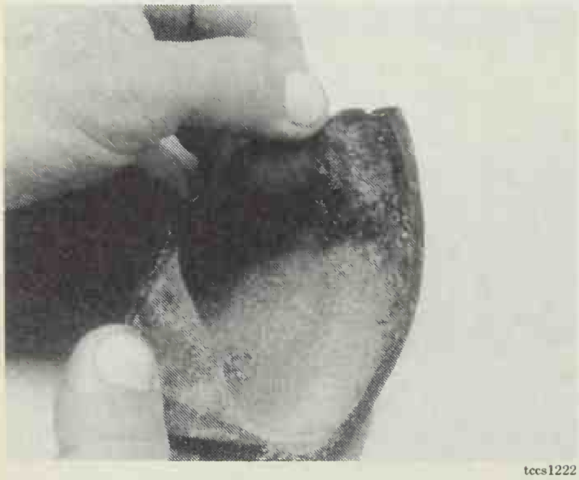

Fig. 98 Debris or contaminants in the cooling system can cause a hose to weaken from the inside out

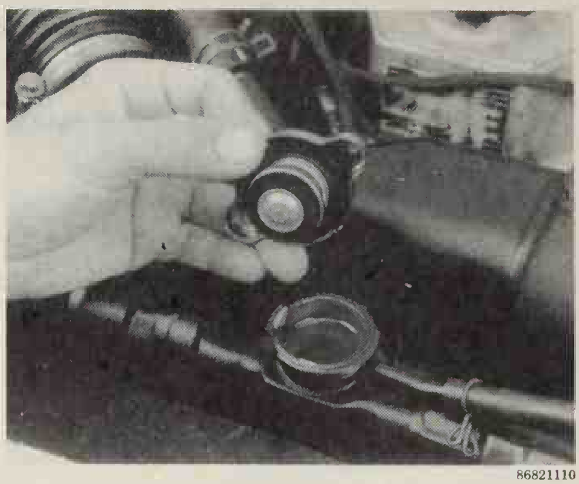

Fig. 99 When the engine is cool, remove the radiator cap

positioned lower on the engine, such as a lower radiator hose, the entire cooling system must be emptied.

✳✳CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Loosen the hose clamps at each end of the hose requiring replacement. Clamps are usually either of the spring tension type (which require pliers to squeeze the tabs and loosen) or of the screw tension type (which require screw or hex drivers to loosen). Pull the clamps back on the hose away from the connection.

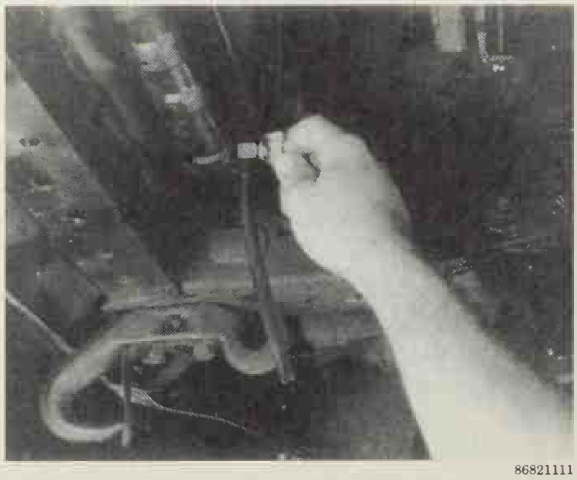

Fig. 100 Attach a short length of hose to the petcock before loosening the nut

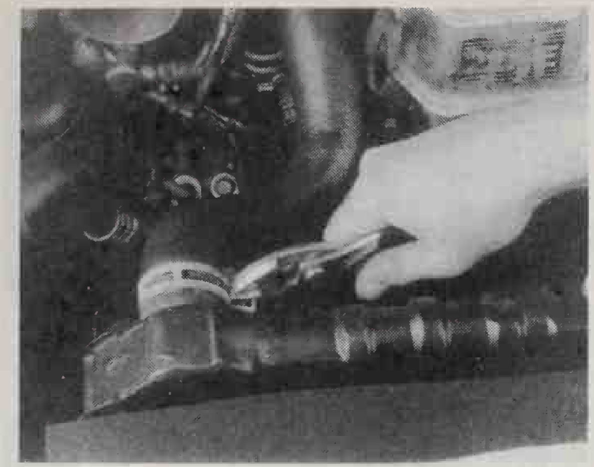
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Fig. 101 Using a pair of pliers, squeeze the tabs to loosen the upper hose

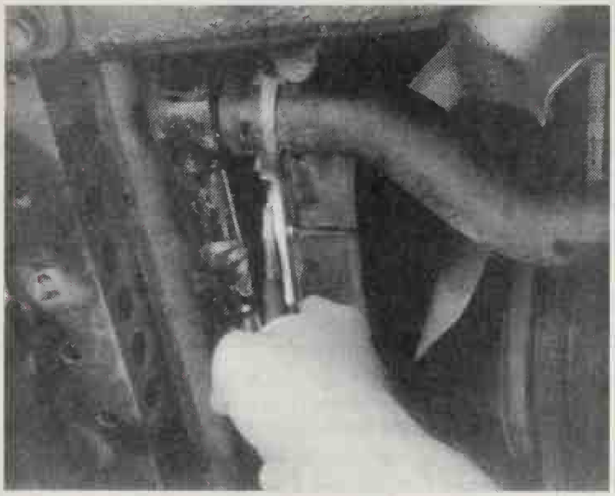
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Fig. 102 As you grasp the hose clamp slide it back

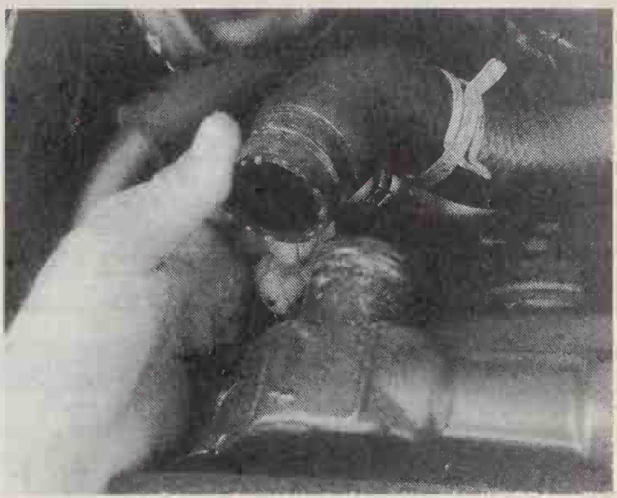
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Fig. 103 Carefully twist, then pull the hose off the neck

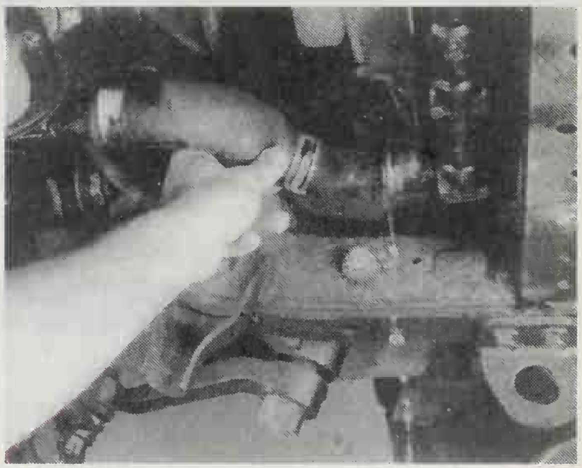
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Fig. 104 When sliding the lower hose off, remember there will be a small amount of fluid still in the hose

4. Twist, pull and slide the hose off the fitting taking care not to damage the neck of the component from which the hose is being removed.

➡If the hose is stuck at the connection, do not try to insert a screwdriver or other sharp tool under the hose end in an effort to free it, as the connection and/or hose may become damaged. Heater connections especially may be easily damaged by such a procedure. If the hose is to be replaced, use a single-edged razor blade to make a slice along the portion of the hose which is stuck on the connection, perpendicular to the end of the hose. Do not cut deep so as to prevent damaging the connection. The hose can then be peeled from the connection and discarded.

5. Clean both hose mounting connections. Inspect the condition of the hose clamps and replace them, if necessary.

To install:

6. Dip the ends of the new hose into clean engine coolant to ease installation.
7. If a clamp shows signs of any damage (bent, too loose, hard to tighten, etc.) now is the time to replace it. A good rule of thumb is that a new hose is always worth new clamps. Slide the clamps over the replacement hose, then slide the hose ends over the connections into position.
8. Position and secure the clamps at least ¼ in. (6.35mm) from the ends of the hose. Make sure they are located inside the raised bead of the connector.
9. Reinstall the petcock and properly refill the cooling system with the clean drained engine coolant or a suitable mixture of ethylene glycol coolant and water.
10. If available, install a pressure tester and check for leaks. If a pressure tester is not available, run the engine until normal

operating temperature is reached (allowing the system to naturally pressurize), then check for leaks.

✻✻CAUTION

If you are checking for leaks with the system at normal operating temperature, BE EXTREMELY CAREFUL not to touch any moving or hot engine parts. Once temperature has been reached, shut the engine OFF, and check for leaks around the hose fittings and connections which were removed earlier.

CV-Boots

INSPECTION

➧ See Figures 105 and 106

The CV (Constant Velocity) boots should should be checked for damage each time the oil is changed and any other time the vehicle is raised for service. These boots keep water, grime, dirt and other damaging matter from entering the CV-joints. Any of these could cause early CV-joint failure which can be expensive to repair. Heavy grease thrown around the inside of the front wheel(s) and on the brake caliper can be an indication of a torn boot. Thoroughly check the boots for missing clamps and tears. If the boot is damaged, have it replaced immediately.

Spark Plugs

➧ See Figure 107

A typical spark plug consists of a metal shell surrounding a ceramic insulator. A metal electrode extends downward through the center of the insulator and protrudes a small distance. Located at the end of the plug and attached to the side of the outer metal shell is the side electrode. The side electrode bends in at a 90° angle so that its tip is just past and parallel to the tip of the center electrode. The distance between these two electrodes (measured in thousandths of an inch or hundredths of a millimeter) is called the spark plug gap.

The spark plug does not produce a spark but instead provides a gap across which the current can arc. The coil produces anywhere from 20,000 to 50,000 volts (depending on the type and application) which travels through the wires to the spark plugs. The current passes along the center electrode and jumps the gap to the side electrode, and in doing so, ignites the air/fuel mixture in the combustion chamber.

SPARK PLUG HEAT RANGE

➧ See Figure 108

Spark plug heat range is the ability of the plug to dissipate heat. The longer the insulator (or the farther it extends into the engine), the hotter the plug will operate; the shorter the insulator (the closer the electrode is to the block's cooling passages) the cooler it will operate. A plug that absorbs little heat and remains too cool will quickly accumulate deposits of oil and carbon since it is not hot enough to burn them off. This leads

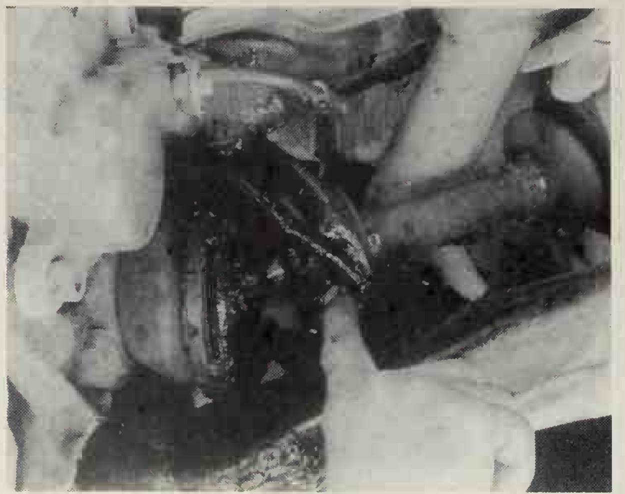

Fig. 106 A torn boot should be replaced immediately

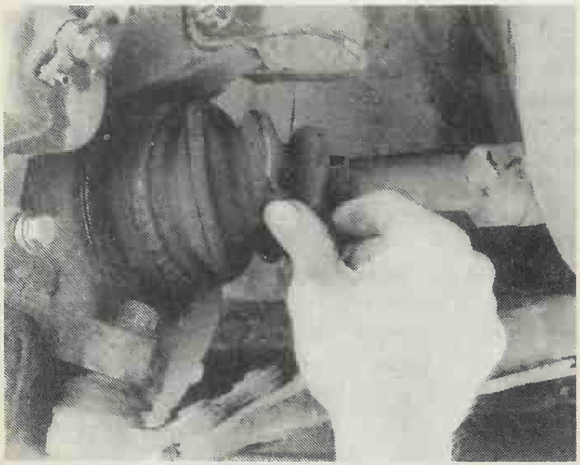

Fig. 105 CV-Boots must be inspected periodically for damage

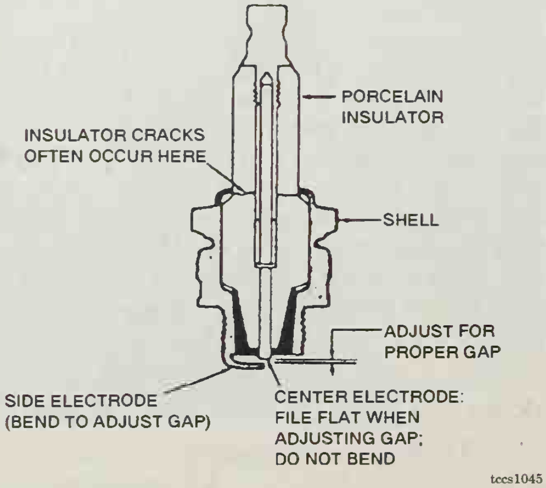
PORCELAIN INSULATOR
INSULATOR CRACKS OFTEN OCCUR HERE
SHELL
ADJUST FOR PROPER GAP
SIDE ELECTRODE (BEND TO ADJUST GAP)
CENTER ELECTRODE: FILE FLAT WHEN ADJUSTING GAP; DO NOT BEND
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Fig. 107 Cross-section of a spark plug

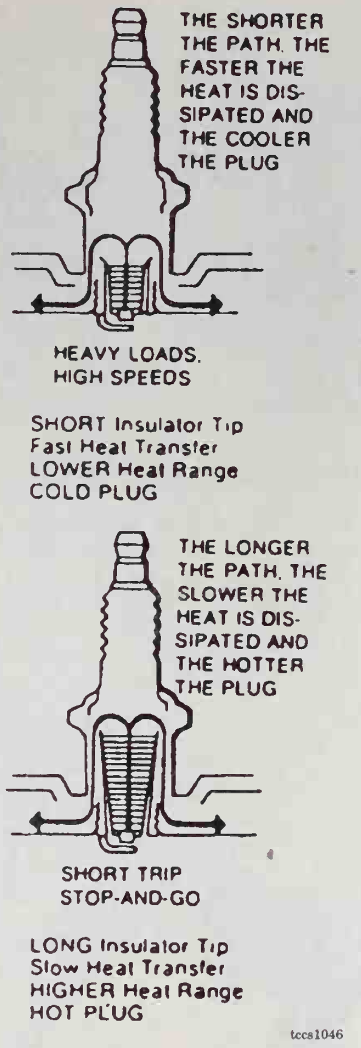

Fig. 108 Spark plug heat range

to plug fouling and consequently to misfiring. A plug that absorbs too much heat will have no deposits but, due to the excessive heat, the electrodes will burn away quickly and might possibly lead to preignition or other ignition problems. Preignition takes place when plug tips get so hot that they glow sufficiently to ignite the air/fuel mixture before the actual spark occurs. This early ignition will usually cause a pinging during low speeds and heavy loads.

The general rule of thumb for choosing the correct heat range when picking a spark plug is: if most of your driving is long distance, high speed travel, use a colder plug; if most of your driving is stop and go, use a hotter plug. Original equipment plugs are generally a good compromise between the 2 styles and most people never have the need to change their plugs from the factory-recommended heat range.

REMOVAL & INSTALLATION

➡Remove the spark plugs and wires one at a time to avoid confusion and miswiring during installation.

1. Disconnect the negative battery cable, and if the vehicle has been run recently, allow the engine to thoroughly cool.
2. Carefully twist the spark plug wire boot to loosen it, then pull upward and remove the boot from the plug. Be sure to pull on the boot and not on the wire, otherwise the connector located inside the boot may become separated.
3. Using compressed air, blow any water or debris from the spark plug well to assure that no harmful contaminants are allowed to enter the combustion chamber when the spark plug is removed. If compressed air is not available, use a rag or a brush to clean the area.

➡Remove the spark plugs when the engine is cold, if possible, to prevent damage to the threads. If removal of the plugs is difficult, apply a few drops of penetrating oil or silicone spray to the area around the base of the plug, and allow it a few minutes to work.

4. Using a spark plug socket that is equipped with a rubber insert to properly hold the plug, turn the spark plug counterclockwise to loosen and remove the spark plug from the bore.

⁂WARNING

Be sure not to use a flexible extension on the socket. Use of a flexible extension may allow a shear force to be applied to the plug. A shear force could break the plug off in the cylinder head, leading to costly and frustrating repairs.

To install:

5. Inspect the spark plug boot for tears or damage. If a damaged boot is found, the spark plug wire must be replaced.
6. Using a wire feeler gauge, check and adjust the spark plug gap. When using a gauge, the proper size should pass between the electrodes with a slight drag. The next larger size should not be able to pass while the next smaller size should pass freely.
7. Carefully thread the plug into the bore by hand. If resistance is felt before the plug is almost completely threaded, back the plug out and begin threading again. In small to reach areas, an old spark plug wire and boot could be used as a threading tool. The boot will hold the plug while you twist the end of the wire and the wire is supple enough to twist before it would allow the plug to crossthread.

⁂WARNING

Do not use the spark plug socket to thread the plugs. Always carefully thread the plug by hand or using an old plug wire to prevent the possibility of cross-threading and damaging the cylinder head bore.

8. Carefully tighten the spark plug. If the plug you are installing is equipped with a crush washer, seat the plug, then tighten about ¼ turn to crush the washer. If you are installing a tapered seat plug, tighten the plug to 11-15 ft. lbs. (15-20 Nm).
9. Apply a small amount of silicone dielectric compound to the end of the spark plug lead or inside the spark plug boot to prevent sticking, then install the boot to the spark plug and push until it clicks into place. The click may be felt or heard, then gently pull back on the boot to assure proper contact.

INSPECTION & GAPPING

See Figures 109, 110, 111, 112, 113, 114, 115, 116 and 117

Check the plugs for deposits and wear. If they are not going to be replaced, clean the plugs thoroughly. Remember that any kind of deposit will decrease the efficiency of the plug. Plugs can be cleaned on a spark plug cleaning machine, which can sometimes be found in service stations, or you can do an acceptable job of cleaning with a stiff brush. If the plugs are cleaned, the electrodes must be filed flat. Use an ignition points file, not an emery board or the like, which will leave deposits. The electrodes must be filed perfectly flat with sharp edges; rounded edges reduce the spark plug voltage by as much as 50%.

Check spark plug gap before installation. The ground electrode (the L-shaped one connected to the body of the plug) must be parallel to the center electrode and the specified size wire gauge (please refer to the Tune-Up Specifications chart for details) must pass between the electrodes with a slight drag.

➡NEVER adjust the gap on a used platinum type spark plug.

Always check the gap on new plugs as they are not always set correctly at the factory. Do not use a flat feeler gauge when measuring the gap on a used plug, because the reading may be inaccurate. A wire type gapping tool is the best way to check the gap. Wire gapping tools usually have a bending tool attached. Use that to adjust the side electrode until the proper distance is obtained. Absolutely never attempt to bend the center electrode. Also, be careful not to bend the side electrode too far or too often as it may weaken and break off within the engine, requiring removal of the cylinder head to retrieve it.

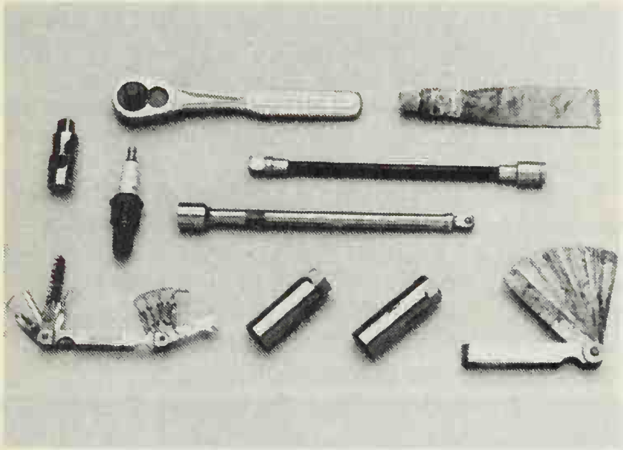
tccs1212

Fig. 109 A variety of tools and gauges are needed for spark plug service

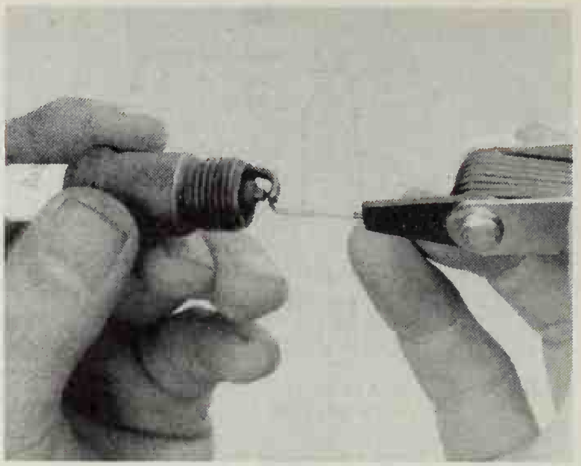
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Fig. 110 Checking the spark plug gap with a feeler gauge

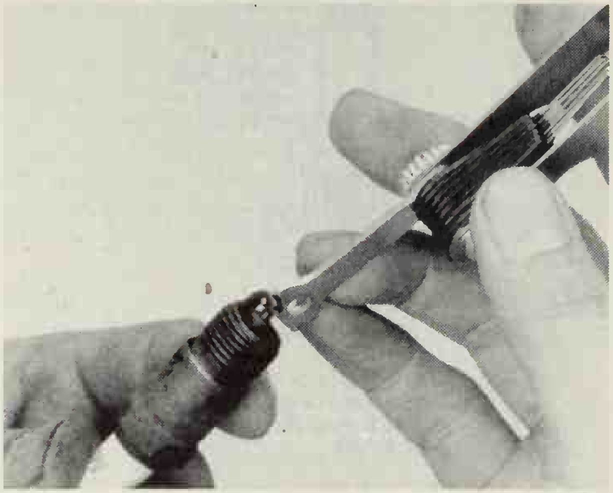
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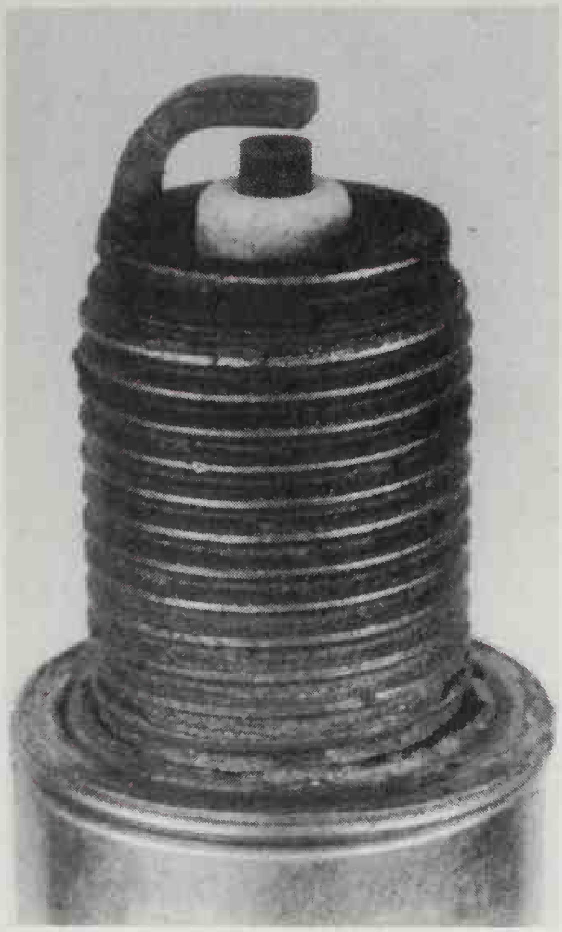
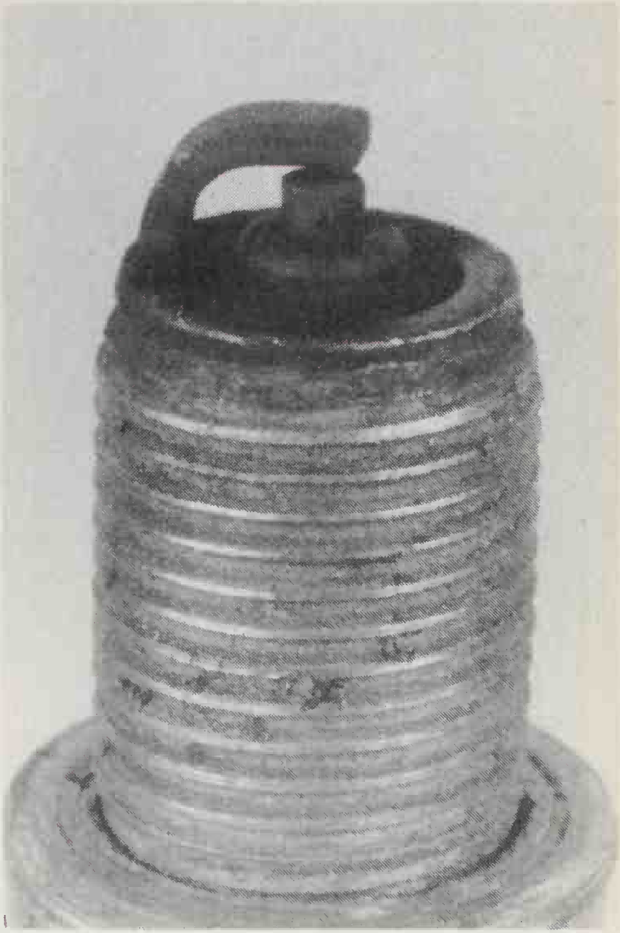
Fig. 111 Adjusting the spark plug gap



tccs2135

Fig. 112 A normally worn spark plug should have light tan or gray deposits on the firing tip



tccs2136

Fig. 113 A carbon fouled plug, identified by soft, sooty, black deposits, may indicate an improperly tuned vehicle. Check the air cleaner, ignition components and engine control system

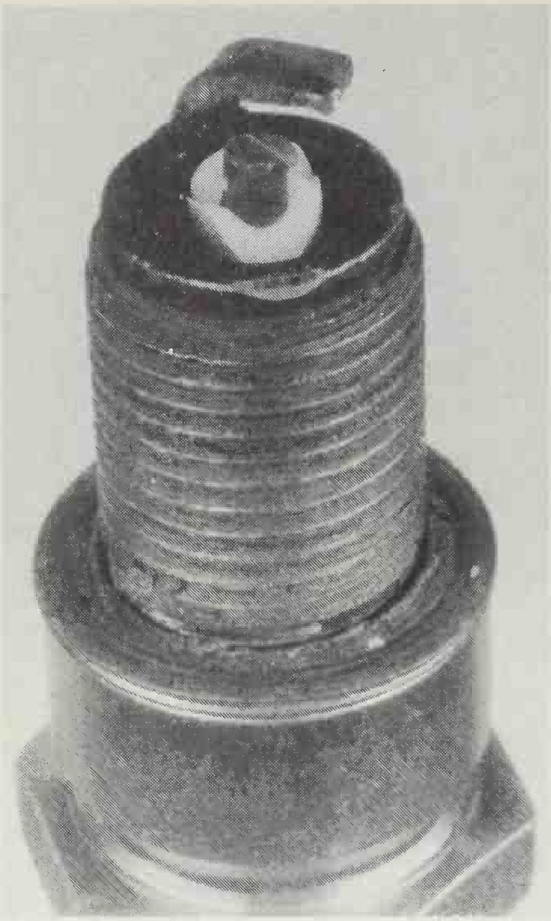

tccs2137

Fig. 114 A physically damaged spark plug may be evidence of severe detonation in that cylinder. Watch that cylinder carefully between services, as a continued detonation will not only damage the plug, but could also damage the engine

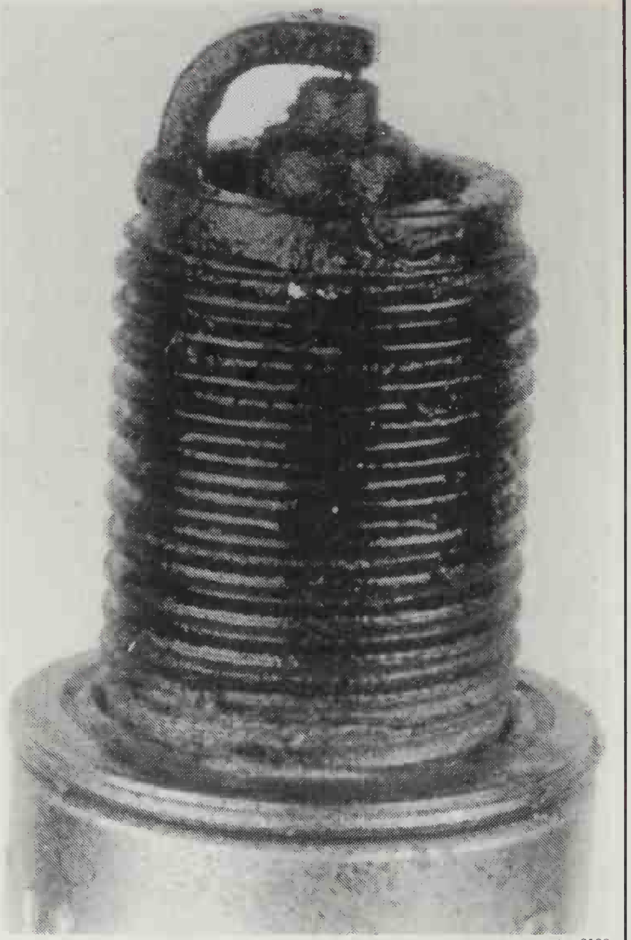

tccs2138

Fig. 115 An oil fouled spark plug indicates an engine with worn piston rings and/or bad valve seals allowing excessive oil to enter the chamber

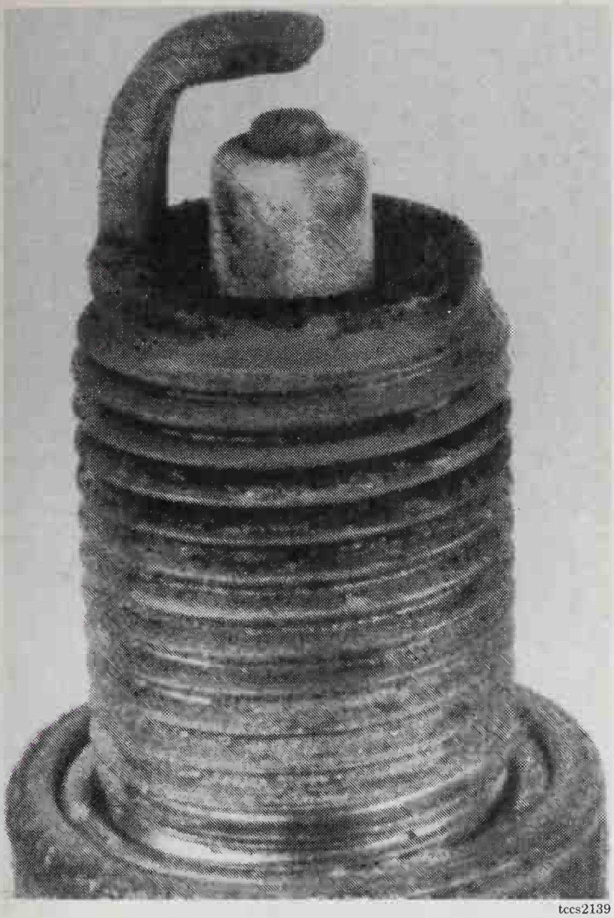


Fig. 116 This spark plug has been left in the engine too long, as evidenced by the extreme gap — Plugs with such an extreme gap can cause misfiring and stumbling accompanied by a noticeable lack of power

Spark Plug Wires

TESTING

➧ See Figures 118 and 119

Every 36,000 miles (58,000 km) or so, the resistance of the wires should be checked with an ohmmeter. Wires with excessive resistance will cause misfiring, and may make the engine difficult to start in damp weather. Generally, the useful life of the cables is 36,000-50,000 miles (58,000-80,000 km).

To check resistance, remove the distributor cap, leaving the wires attached to the cap but removing them from the spark plugs. Look at each contact inside the cap for any sign of cracking or burning. A small amount of discoloration is normal but there should be no heavy burn marks or contact marks. Connect one lead of an ohmmeter to an electrode within the cap; connect the other lead to the corresponding spark plug terminal. Replace any wire which shows a resistance over 25,000 ohms.

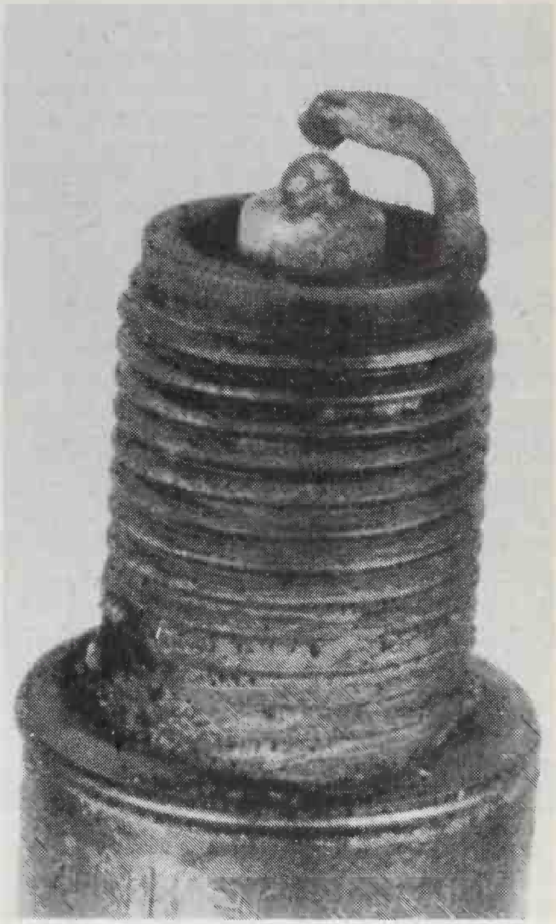


Fig. 117 A bridged or almost bridged spark plug, identified by a build-up between the electrodes caused by excessive carbon or oil build-up on the plug

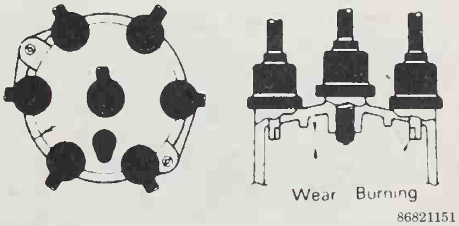


Fig. 118 Check the inside of the cap for burning, cracks or wear

Test the high tension lead from the coil by connecting the ohmmeter between the center contact in the distributor cap and either of the primary terminals of the coil. If resistance is more than 25,000 ohms, remove the cable from the coil and check the resistance of the cable alone. Anything over 15,000 ohms is cause for replacement. It should be remembered that resistance is also a function of length; the longer the cable, the greater the resistance. Thus, if the cables on your truck are longer than the factory originals, resistance will be higher, quite possibly outside these limits. Toyota recommends the 25,000 ohm limit be observed in all cases.

REMOVAL & INSTALLATION

See Figure 120

At every tune-up, visually inspect the spark plug cables for burns, cuts, or breaks in the insulation. Check the boots and the nipples on the distributor cap and coil. Replace any damaged wiring. Always replace spark plug wiring in sets, with a coil wire as well. Length is important; get the correct set for your vehicle.

When installing new cables, replace them one at a time to avoid mix-ups. Start by replacing the longest one first. Install the boot firmly over the spark plug. Route the wire over the same path as the original. Insert the nipple firmly into the tower on the cap or the coil.

Distributor Cap and Rotor

REMOVAL & INSTALLATION

See Figures 121, 122, 123 and 124

1. Disconnect the negative battery cable.
2. Remove the distributor cap rubber boot if equipped.
3. Loosen the screws securing the cap on the distributor.
4. Usually it is helpful to tag the wires leading to the cap for easy identification on installation.

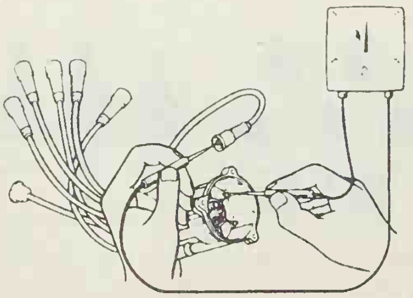


Fig. 119 Use an ohmmeter to test the high tension wires

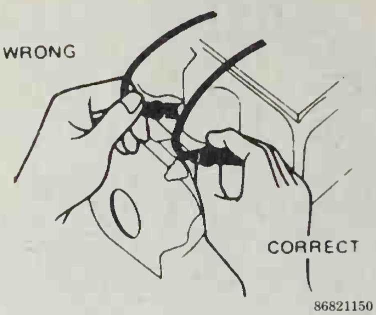


Fig. 120 Never pull on the wire; always grasp the boot of the spark plug wire

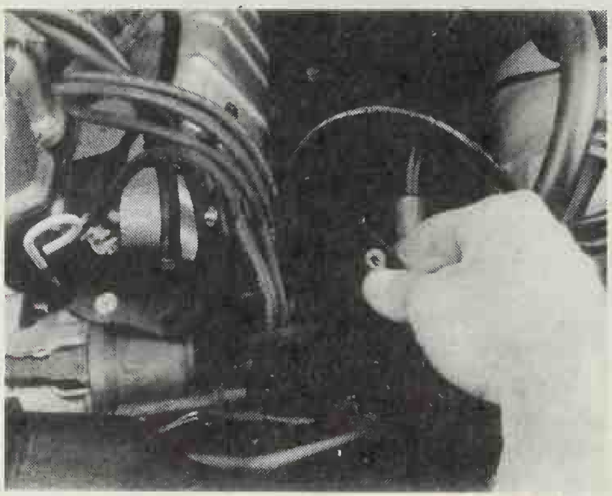


Fig. 121 Unsnap and remove the distributor boot

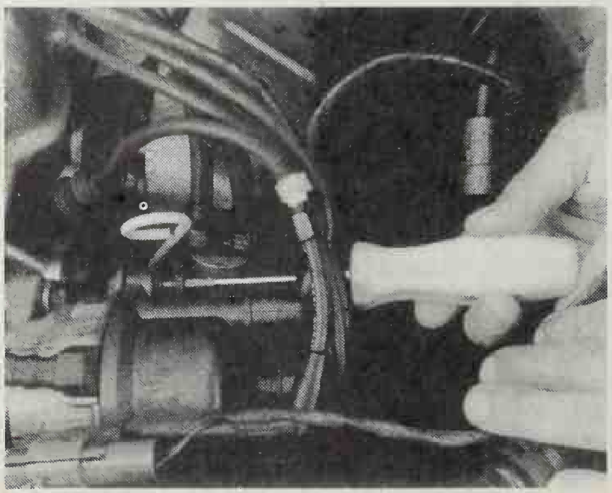


Fig. 122 Loosen the screws securing the cap

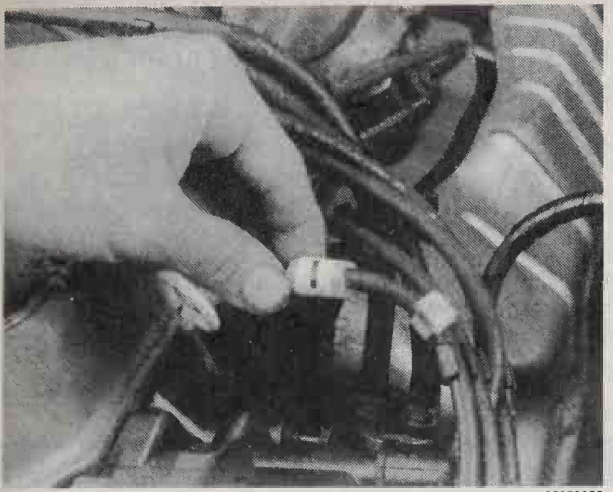


Fig. 123 It is helpful to tag the wires on the cap

5. Lift the cap off the distributor. Pulling from the wire boot, remove the plug wires from the cap.
6. Once the cap and wires are off, lift the rotor off the shaft.

To install:

7. Install the rotor onto the distributor shaft. The rotor only goes on one way so there should be no mix-up in replacement.
8. Apply a small amount of dielectric grease on the tip of the rotor and the inside of the cap carbon ends.
9. Attach the tagged wires to their proper locations on the cap.
10. Fit the cap onto the distributor, then tighten the bolts.
11. Make sure all the wires are secure on the cap and spark plugs. Install the negative battery cable.
12. Start the vehicle and check for any misses.

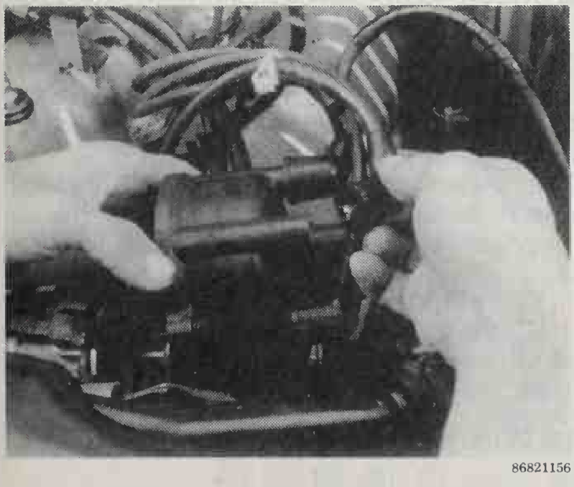


Fig. 124 Pull the wires off the cap from the boot, not the wire itself

INSPECTION

When inspecting a cap and rotor, look for signs of cracks, burns and wear. The inside of the cap may be burnt or have wear on the carbon ends. On the rotor look at the tip for burning and excessive wear.

Ignition Timing

GENERAL INFORMATION

Ignition timing is the measurement in degrees of crankshaft rotation at the instant the spark plug fires while the piston is on its compression stroke.

Ignition timing is adjusted by loosening the distributor locking device and turning the distributor in its mount.

Ideally, the air/fuel mixture in the cylinder will be ignited by the spark plug and just beginning its rapid expansion as the piston passes Top Dead Center (TDC) of the compression stroke. If this happens, the piston will be beginning the power stroke just as the compressed air/fuel mixture starts to burn and expand. The expansion (explosion) of the air/fuel mixture will then force the piston down on the power stroke and turn the crankshaft.

It takes a fraction of a second for the spark from the plug to completely ignite the mixture in the cylinder. Because of this, the spark plug must fire before the piston reaches TDC, if the mixture is to be completely ignited as the piston passes TDC. This measurement is given in degrees of crankshaft rotation before the piston reaches top dead center (BTDC). If the ignition timing setting for your engine is seven (7°) BTDC, this means that the spark plug must fire at the time when the piston for that cylinder is 7° before reaching the top of its compression stroke. However, this only holds true while your engine is at idle speed.

As the engine accelerates from idle, the speed of the engine (rpm, or revolutions per minute) increases. The increase in rpm means that the pistons are now traveling up and down much faster. Because of this, the spark plugs will have to fire even sooner if the mixture is to be completely ignited as the piston passes TDC. To accomplish this, the distributor incorporates means to advance the timing of the spark as engine speed increases.

The distributor in your Toyota has at least two means of advancing the ignition timing. One is called centrifugal advance and is actuated by weights in the distributor. The other is called vacuum advance and is controlled by that larger circular housing on the side of the distributor. In many later models, the vacuum advance is replaced by full computerized control, thanks to the Engine Control Unit or ECU.

This function is known as Electronic Spark Advance (ESA) and is accomplished by Toyota's programming of the ECU. By monitoring the rpm, intake air volume, engine temperature, throttle position and other variables, the microprocessor decides the correct moment to trigger the spark for any engine operating condition from cold idle through wide open throttle. The system is simple, non-adjustable and reliable.

In addition, some early distributors have a vacuum retard mechanism which is contained in the same housing on the side of the distributor as the vacuum advance. The function of this mechanism is to retard the timing of the ignition spark under certain engine conditions. This causes more complete burning of the air/fuel mixture in the cylinder and consequently lowers exhaust emissions. Both the vacuum advance and the vacuum retard have vacuum hoses connected to them. Don't get them mixed up during removal.

Because these mechanisms change ignition timing, it is necessary to disconnect and plug the one or two vacuum lines from the distributor when setting the basic ignition timing.

If ignition timing is set too far advanced (BTDC), the ignition and expansion of the air/fuel mixture in the cylinder will try to force the piston down in the cylinder while it is still traveling upward. This causes engine "ping", a sound which resembles marbles being dropped into an empty tin can. If the ignition timing is too far retarded (after, or ATDC), the piston will have already started down on the power stroke when the air/fuel mixture ignites. This will cause the piston to be forced down only a portion of its travel, resulting in poor engine performance and lack of power.

INSPECTION AND ADJUSTMENT

Ignition timing adjustment is checked with a timing light. This instrument is inductively connected to the number one (No. 1) spark plug of the engine as well as to the two battery terminals. The timing light flashes every time an electrical current is sent from the distributor through the No. 1 spark plug wire to the spark plug.

Except for the 3F-E engine, the crankshaft pulley and the front cover of the engine are marked with a timing pointer and a timing scale. On Land Cruisers with the 3F-E, the timing mark is found be removing the small rubber plug at the rear of the engine where it meets the transmission. The plug is located on the same side of the engine as the spark plugs.

When the timing pointer is aligned with the **0** mark on the timing scale, the piston in the No. 1 cylinder is at TDC of its compression stroke. With the engine running, and the timing light aimed at the timing pointer and timing scale, the stroboscopic flashes from the timing light will allow you to check the ignition timing setting of the engine. The timing light flashes every time the spark plug in the No. 1 cylinder of the engine fires. Since the flash from the timing light makes the crankshaft pulley seem stationary for a moment you will be able to read the exact position of the piston in the No. 1 cylinder on the timing scale on the front of the engine.

Because your Toyota has electronic ignition, always use a timing light with an inductive pickup. This pickup simply clamps onto the No. 1 plug wire, eliminating any adapters. It is not as susceptible to crossfiring or false triggering, which may occur with a conventional light.

22-R Engine

1. Warm-up the engine, then turn the ignition **OFF**. Connect a tachometer to both battery terminals and to the service connector coming from the distributor.
2. Clean off the timing marks. The marks are on the crankshaft pulley and timing cover. The timing notches in the crankshaft pulley are normally marked at the factory with red or white paint. You may want to retouch them if they are dark, using chalk or paint. Fluorescent (dayglow) paint is excellent for this purpose. You might have to bump the engine around with the starter (just touch the key to the **START** position very briefly) to find the pulley marks.
3. Connect a timing light according to the manufacturer's instructions.
4. Disconnect the vacuum line(s) from the distributor vacuum unit. Clamp or plug the line(s); golf tees are excellent for this job. Any vacuum leak will make the engine run poorly.

➡On 22R engines with High Altitude Compensation (HAC) systems, there are two vacuum hoses which connect to the distributor. Both must be disconnected and plugged.

5. Be sure that the all wires are clear of the fan and moving belts, pulleys etc. Start the engine.

⁑CAUTION

Keep fingers, clothes, tools, hair, and wiring leads clear of the all moving parts. Be sure that you are running the engine in a well ventilated area.

6. Allow the engine to run at idle speed with the gear shift in Neutral (manual) and Park (P) with automatic transmission. Use the tachometer to check idle speed and adjust the idle if necessary.

⁑CAUTION

Be sure that the parking brake is set and that the front wheels are blocked to prevent the vehicle from rolling.

7. Point the timing light at the marks indicated in the chart and illustrations. With the engine at idle, timing should be at the specification given on the "Tune-Up Specifications" chart.
8. If the timing is not at the specification, loosen the pinch bolt (hold-down bolt) at the base of the distributor just enough so that the distributor can be turned. Turn the distributor to advance or retard the timing as required. Once the proper marks are seen to align, timing is correct. Tighten the hold-down bolt.

➡Remember that you are using metal tools on a running engine. Watch out for moving parts and don't touch any of the spark plug wires with the wrench.

9. Recheck the timing. Stop the engine; disconnect the tachometer and timing light. Except for engines equipped with HAC, connect the vacuum line(s) to the distributor vacuum unit.
10. On engines with HAC (identified in the NOTE earlier), after setting the initial timing, reconnect the vacuum hose at the distributor. Recheck the timing. It should now be about 13° BTDC.
11. If the advance is still about 8°, pinch the hose between the HAC valve and the three way connector. It should now be about 13°. If not, the HAC valve should be checked for proper operation.

22R-E, 3VZ-E and 3F-E Engines

▸ See Figures 125, 126, 127 and 128

1. Warm up the engine, then turn it **OFF**. Connect a timing light to the engine following the manufacturer's instructions.

2. Connect a tachometer to both battery terminals. Connect the tachometer probe to the IG-terminal in the check connector box. The check connector box is located next to the underhood fuse and relay box on trucks and 4Runner's; for Land Cruisers, the check connector box is on the firewall. Use the correct adapter to insure a tight fit on the terminal. Not all tachometers, particularly older ones are electrically compatible with this system. Read instructions for your unit before using.

3. Start the engine and run it at idle. Check the idle speed on the tachometer; adjust it to specification if necessary.

4. At the check connector, use a small jumper wire to short the connector at terminal T or TE1 and terminal E1, of the DLC1 as shown. Special service tool (SST) 09843-18020 or its equivalent can be used for this also.

➡This jumper will be used repeatedly during diagnostics in later sections. Take the time to make a proper jumper with correct terminals or probes. It's a valuable special tool for very low cost.

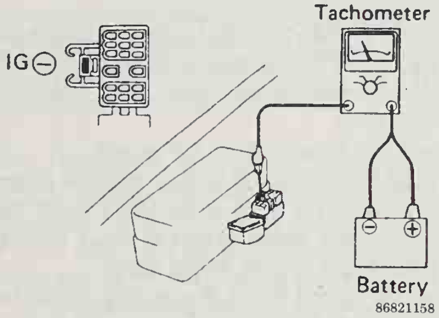


Fig. 125 Attach the tachometer as shown

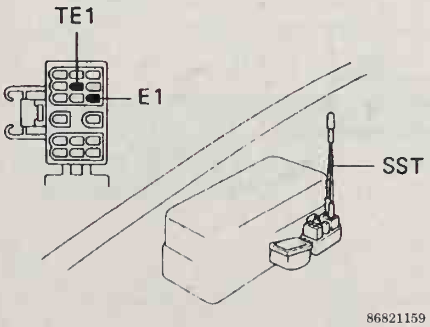


Fig. 126 Connect the SST or jumper wire to the TE1 and E1 terminals of the DLC1

5. Check the idle speed, then check the ignition timing. The 22R-E should read 5° BTDC, 3VZ-FE should read 10° BTDC and the 3F-E should read 7° BTDC. All of these readings are at idle.

6. Loosen the distributor pinch bolt just enough that the distributor can be turned. Aim the timing light at the marks on the crankshaft pulley (or the drive plate on 3F-E) and slowly turn the distributor until the correct timing mark aligns with the pointer. Tighten the distributor pinch bolt.

7. Remove the jumper wire or special service tool (SST) from the DLC1.

8. Check that the ignition timing advances. At idle the 22R-E should read 10°-14° BTDC, 3VZ-FE should read 8° BTDC, and the 3F-E should read 12° BTDC.

9. Shut the engine **OFF** and remove the timing light and tachometer leads.

1FZ-FE Engine

➧ See Figures 129, 130 and 131

➡Toyota's hand-held tester or an equivalent OBD-II scan tool must be used for this procedure.

1. Warm the engine to normal operating temperature.
2. Connect an OBD-II compliant scan tool to the DLC3 located under the dash on the driver's side. Refer to Section 4 for more information.
3. Connect the timing light to the engine.
4. Race the engine to 2500 rpm for approximately 90 seconds. Check the idle speed. It should read 600-700 rpm.
5. Using SST 09843-18020 or its equivalent jumper wire, connect terminals TE1 and E1 of the DLC1 under the hood.
6. With the transmission in neutral and the A/C off, check the timing. It should read 3° BTDC at idle.
7. Loosen the hold-down bolt, and adjust it by turning the distributor. Tighten the hold-down bolt to 13 ft. lbs. (18 Nm), then recheck the ignition timing again.
8. Remove the jumper wire from the DLC1.
9. Check the timing, the reading should be 2°-13° BTDC at idle. The timing mark will move in this range.
10. Disconnect the timing light from the engine.
11. Disconnect the scan tool.

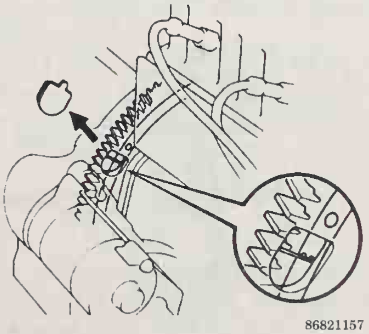


Fig. 127 On 3-FE engines, remove the rubber plug at the rear of the engine to view the timing mark

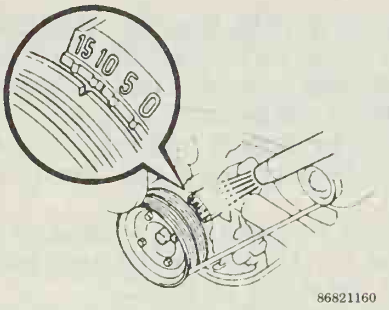


Fig. 128 On other engines, the timing mark is visible on the crankshaft pulley

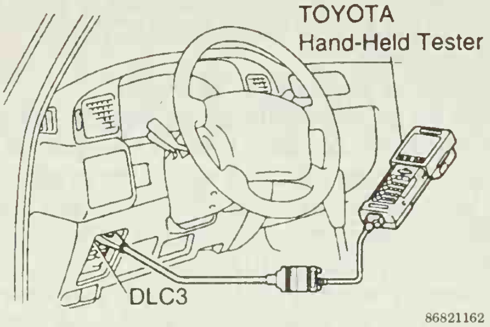


Fig. 129 An OBD-II compliant scan tool must be connected to DLC3

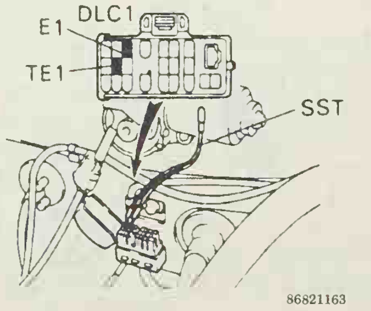


Fig. 130 SST 09843-18020 or a jumper wire may be used to connect terminals TE1 and E1 of the DLC1

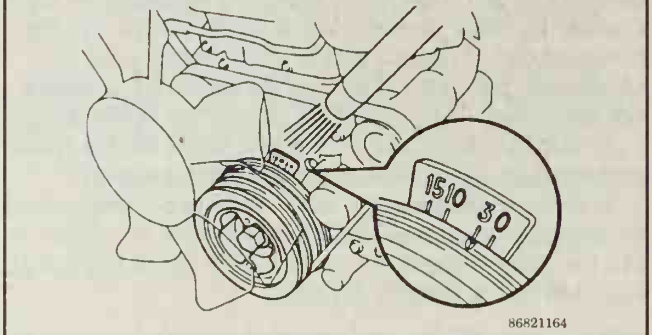


Fig. 131 The timing should be 3° BTDC at idle

2RZ-FE and 3RZ-FE Engines

➧ See Figures 129, 132 and 133

➡Toyota's hand-held tester or an equivalent OBD-II scan tool must be used for this procedure.

1. Warm the engine to normal operating temperature.
2. Connect an OBD-II compliant scan tool to the DLC3 located under the dash on the driver's side. Refer to Section 4 for more information.
3. Connect the timing light to the engine.
4. Using SST 09843-18020 or its equivalent jumper wire, connect terminals TE1 and E1 of the DLC1 under the hood.
5. After the engine speed is kept at about 1000 rpm for 5 seconds, check that it returns to idle speed.
6. Check the ignition timing, the reading should be 3°-7° BTDC at idle.
7. Remove the jumper wire from the DLC1.
8. Recheck the timing, the mark ranges from 7°-18° BTDC at idle.
9. Disconnect the scan tool.
10. Disconnect the timing light.

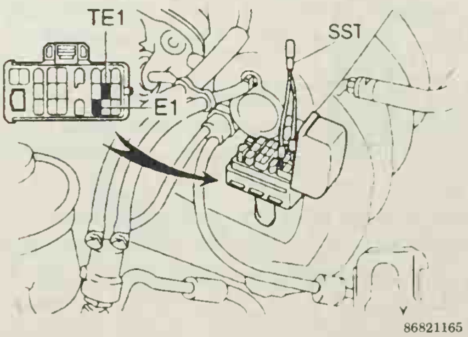


Fig. 132 Using the SST 09843-18020 or a jumper wire, connect terminals TE1 and E1 of the DLC1

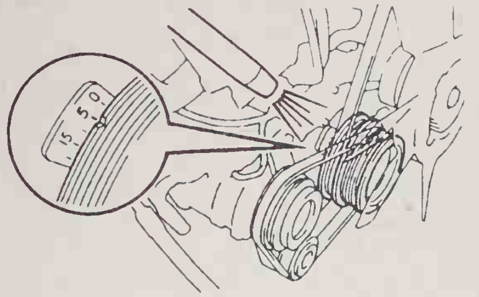


Fig. 133 The timing should be between 3° and 7° BTDC at idle

Valve Lash Adjustment

See Figures 134 and 135

As part of every major tune-up or service interval, the valve clearance should be checked and adjusted if necessary. For all trucks and 4Runner's covered by this book, the specification is every 30,000 miles (48,000 km) or 36 months. For all Land Cruisers, the requirement is 15,000 miles (24,000 km) or 18 months.

If the valve clearance is too large, part of the lift of the camshaft will be used up in removing the excessive clearance, thus the valves will not be opened far enough. This condition makes the valve train noisy as they take up the excessive clearance, and the engine will perform poorly, since a smaller amount of air/fuel mixture will be admitted to the cylinders. The exhaust valves will not open far enough to vent the cylinder completely; retained pressure (back pressure) will restrict the entry of the next air/fuel charge. If the valve clearance is too small, the intake and exhaust valves will not fully seat on the cylinder head when they close. This causes internal cylinder leakage and prevents the hot valve from transferring some heat to the head and cooling off. Therefore, the engine will run poorly (due to gases escaping from the combustion chamber), and the valves will overheat and warp (since they cannot transfer heat unless they are firmly touching the seat in the cylinder head).

➡While all valve adjustments must be as accurate as possible, it is better to have the valve adjustment slightly loose than slightly tight, as burnt valves may result from overly tight adjustments.

ADJUSTMENT

22R and 22R-E

See Figures 136, 137, 138 and 139

1. Start the engine and warm it up to normal operating temperature.
2. Turn the engine **OFF**. Remove the air cleaner and housing, along with the hot air and cold air intake ducts.

⁂CAUTION

Components will be hot. The engine head, block and radiator will be very hot.

3. Remove any other hoses, cables, or wires attached to the valve cover. The valve cover (or cylinder head cover) is the domed steel item with the oil filler in it.
4. Remove the small nuts holding the valve cover, then lift the cover off. Retrieve the rubber gasket and put it aside; it can be reused if not damaged or crushed out of shape. Beware of hot oil dripping from the inside of the cover.
5. Use a large wrench on the crankshaft pulley bolt to turn the engine clockwise until the timing mark on the pulley to **0** on the scale. Turning the engine will be easier if the spark plugs are removed, but this is not required.

⁂CAUTION

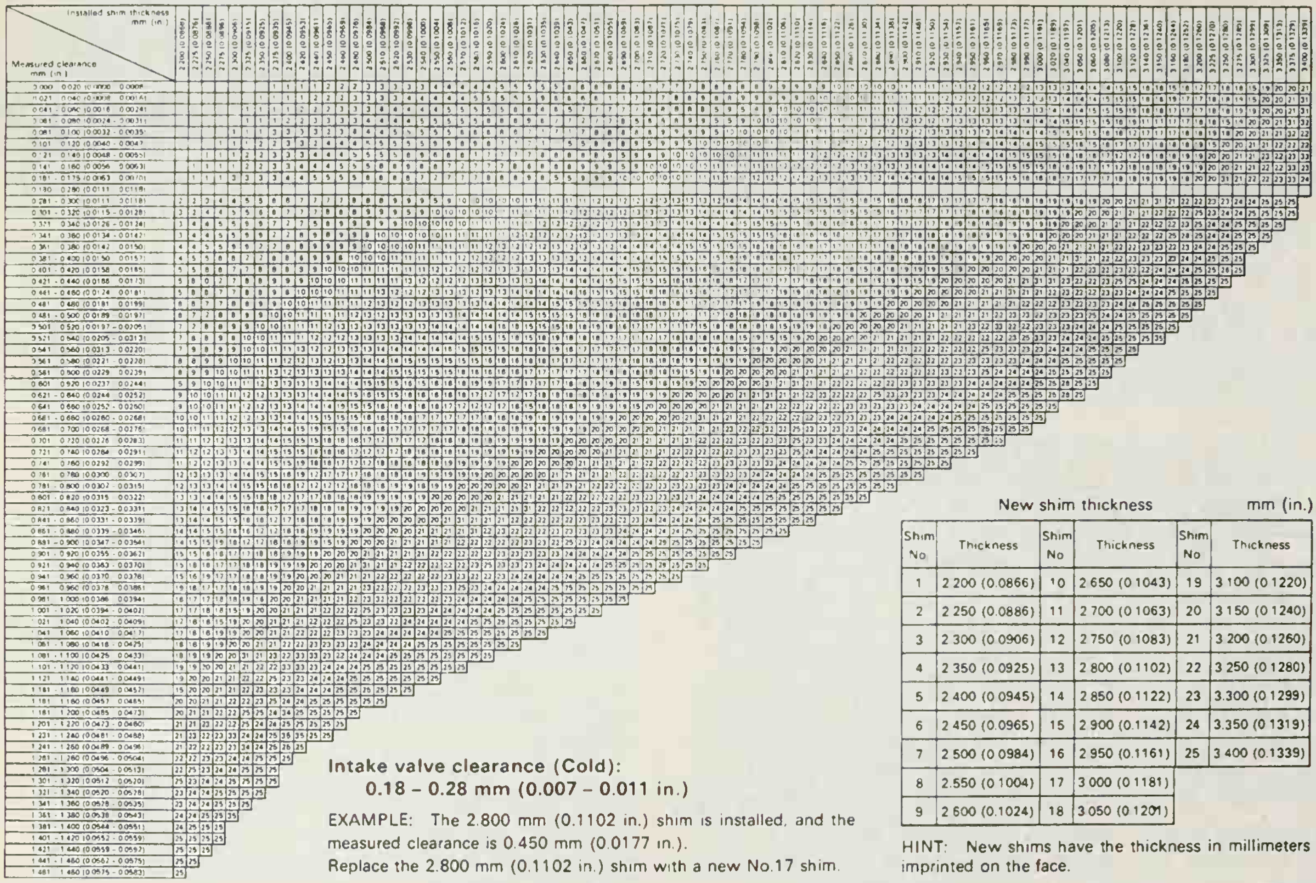
Do not attempt to align the engine by using the ignition switch to turn the engine. Doing will splash hot oil onto everything in the area, including you.

6. Check that the rockers on No.**1** cylinder are loose and the rockers on No.4 are under tension. (No.**1** is closest to the radiator; No. 4 is closest to the firewall.) If this is true, the engine is aligned with No.1 piston at top dead center. If it is not true, turn the engine one full revolution clockwise and realign the timing mark at zero; recheck the rockers.
7. Adjust the clearance 0.008 in. (0.20mm) intake and 0.012 in. (0.30mm) exhaust. Insert a feeler gauge and check for proper clearance between the top of the valve stem and the bottom of the rocker arm on the No. 1 intake valve. To adjust, loosen the locknut on the end of the rocker arm and turn the adjusting screw until the clearance is correct. Tighten the locknut and recheck the clearance; there should be a slight drag felt when the feeler gauge is pulled through the gap. Repeat the procedure for No 1 exhaust, No 2 intake and No. 3 exhaust.
8. Turn the crankshaft pulley one full rotation clockwise until the marks align at **0** and for the remaining valves.
9. Clean the valve cover thoroughly with a lint-free rag. Wipe any oil off the cylinder head edges in the area of the valve cover gasket.
10. Fit the gasket into the valve cover, making sure it is not crimped or twisted. If the half-moon rubber plugs came out of the valve cover, clean them and apply sealant to the part of the plug contacting the valve cover; install the half-moon plug.

➡The use of sealants on the valve cover gasket is not recommended.

11. Install the valve cover onto the head. Make certain is squarely seated and not pinching any adjacent wires or cables.
12. Install the valve cover retaining nuts. Tighten them to 43-60 inch lbs. (5-7 Nm) This is little more than finger-tight; overtightening will deform the cover and cause leaks.
13. Connect the lines, hoses and cables which were removed for access. Make certain electrical and ignition wires are firmly held by their clips or brackets.

Adjusting Shim Selection Chart (Intake)


Installed shim thickness mm (in.)
Measured clearance mm (in.)

Intake valve clearance (Cold):
0.18 – 0.28 mm (0.007 – 0.011 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.17 shim.

New shim thickness mm (in.)

Shim No	Thickness	Shim No	Thickness	Shim No	Thickness
1	2.200 (0.0866)	10	2.650 (0.1043)	19	3.100 (0.1220)
2	2.250 (0.0886)	11	2.700 (0.1063)	20	3.150 (0.1240)
3	2.300 (0.0906)	12	2.750 (0.1083)	21	3.200 (0.1260)
4	2.350 (0.0925)	13	2.800 (0.1102)	22	3.250 (0.1280)
5	2.400 (0.0945)	14	2.850 (0.1122)	23	3.300 (0.1299)
6	2.450 (0.0965)	15	2.900 (0.1142)	24	3.350 (0.1319)
7	2.500 (0.0984)	16	2.950 (0.1161)	25	3.400 (0.1339)
8	2.550 (0.1004)	17	3.000 (0.1181)		
9	2.600 (0.1024)	18	3.050 (0.1201)		

HINT: New shims have the thickness in millimeters imprinted on the face.

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Fig. 134 Adjusting shim chart for the intake valves

Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.) / Measured clearance mm (in.)	2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.650 (0.1043)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1165)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1205)	3.070 (0.1209)	3.080 (0.1213)	3.090 (0.1217)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.250 (0.1280)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
0.000 – 0.030 (0.0000 – 0.0012)																		1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	10	10	10	10	11	11
0.031 – 0.050 (0.0012 – 0.0020)															1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	9	9	9	9	10	10	11	11	11	11	12
0.051 – 0.070 (0.0020 – 0.0028)													1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.071 – 0.090 (0.0028 – 0.0035)												1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.091 – 0.110 (0.0036 – 0.0043)											1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.111 – 0.130 (0.0044 – 0.0051)									1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13
0.131 – 0.150 (0.0052 – 0.0059)								1	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	11	11	11	11	12	12	13	13	13	13	14
0.151 – 0.170 (0.0059 – 0.0067)							1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.171 – 0.190 (0.0067 – 0.0075)						1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.191 – 0.210 (0.0075 – 0.0083)					1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.211 – 0.230 (0.0083 – 0.0091)			1	1	1	1	1	2	2	2	3	3	4	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	14	14	14	15	15	15
0.231 – 0.249 (0.0091 – 0.0098)		1	1	1	1	1	2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	13	13	13	13	14	14	15	15	15	15	16
0.250 – 0.350 (0.0098 – 0.0138)																																																																	
0.351 – 0.370 (0.0138 – 0.0146)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	17	17	17	17	17	
0.371 – 0.390 (0.0146 – 0.0154)	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17	17		
0.391 – 0.410 (0.0154 – 0.0161)	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	16	16	16	17	17	17	17				
0.411 – 0.430 (0.0162 – 0.0169)	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	17	17	17	17					
0.431 – 0.450 (0.0170 – 0.0177)	4	4	5	5	5	5	6	6	7	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	17	17	17	17	17						
0.451 – 0.470 (0.0178 – 0.0185)	4	5	5	5	5	6	6	7	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	17	17	17	17	17							
0.471 – 0.490 (0.0185 – 0.0193)	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17								
0.491 – 0.510 (0.0193 – 0.0201)	5	5	6	6	6	7	7	7	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17										
0.511 – 0.530 (0.0201 – 0.0209)	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17											
0.531 – 0.550 (0.0209 – 0.0217)	6	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17												
0.551 – 0.570 (0.0217 – 0.0224)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17														
0.571 – 0.590 (0.0225 – 0.0232)	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																
0.591 – 0.610 (0.0233 – 0.0240)	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																		
0.611 – 0.630 (0.0241 – 0.0248)	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																				
0.631 – 0.650 (0.0248 – 0.0256)	8	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																						
0.651 – 0.670 (0.0256 – 0.0264)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																								
0.671 – 0.690 (0.0264 – 0.0272)	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																										
0.691 – 0.710 (0.0272 – 0.0280)	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																												
0.711 – 0.730 (0.0280 – 0.0287)	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																														
0.731 – 0.750 (0.0288 – 0.0295)	10	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																
0.751 – 0.770 (0.0296 – 0.0303)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																		
0.771 – 0.790 (0.0304 – 0.0311)	11	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																				
0.791 – 0.810 (0.0311 – 0.0319)	11	11	12	12	12	13	13	13	14	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																						
0.811 – 0.830 (0.0319 – 0.0327)	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																								
0.831 – 0.850 (0.0327 – 0.0335)	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	17	17	17																																										
0.851 – 0.870 (0.0335 – 0.0343)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	17	17	17	17	17	17	17																																												
0.871 – 0.890 (0.0343 – 0.0350)	13	13	13	14	14	14	15	15	15	16	16	16	16	17	17	17	17	17	17																																														
0.891 – 0.910 (0.0351 – 0.0358)	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	17																																																
0.911 – 0.930 (0.0359 – 0.0366)	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17																																																		
0.931 – 0.950 (0.0367 – 0.0374)	14	14	15	15	15	15	16	16	17	17	17	17	17																																																				
0.951 – 0.970 (0.0374 – 0.0382)	14	15	15	15	15	16	16	17	17	17	17	17																																																					
0.971 – 0.990 (0.0382 – 0.0390)	15	15	15	16	16	16	17	17	17	17	17																																																						
0.991 – 1.010 (0.0390 – 0.0398)	15	15	16	16	16	17	17	17	17																																																									
1.011 – 1.030 (0.0398 – 0.0406)	15	16	16	16	17	17	17	17																																																										
1.031 – 1.050 (0.0406 – 0.0413)	16	16	17	17	17	17	17																																																											
1.051 – 1.070 (0.0414 – 0.0421)	16	17	17	17	17	17																																																												
1.071 – 1.090 (0.0422 – 0.0429)	17	17	17	17	17																																																													
1.091 – 1.110 (0.0430 – 0.0437)	17	17	17																																																																
1.111 – 1.130 (0.0437 – 0.0445)	17	17																																																																	
1.131 – 1.150 (0.0445 – 0.0453)	17																																																																		

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.010 – 0.014 in.)
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 10 shim.

HINT: New shims have the thickness in millimeters imprinted on the face.

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Fig. 135 Adjusting shim chart for the exhaust valves

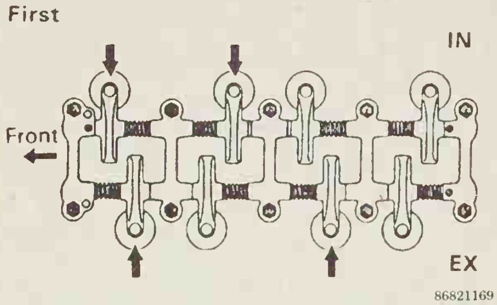

Fig. 136 Adjust the clearance of half the valves, do the arrowed ones first

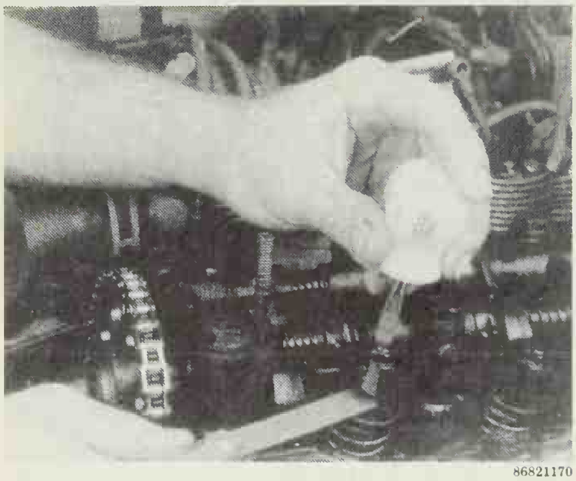

Fig. 137 Use a gauge to measure the distance between the stem and the rocker arm

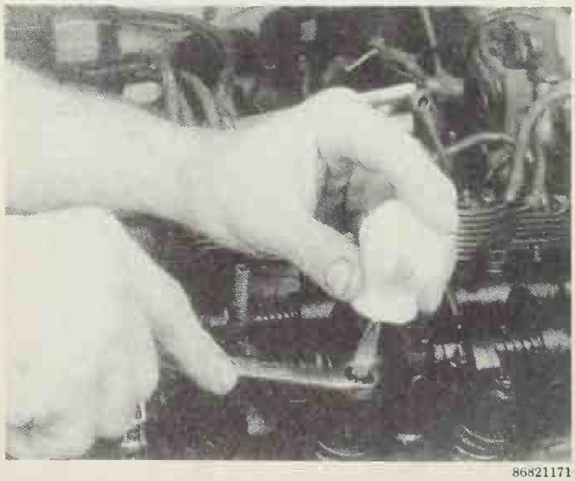

Fig. 138 Hold the adjusting screw in position, then tighten the locknut

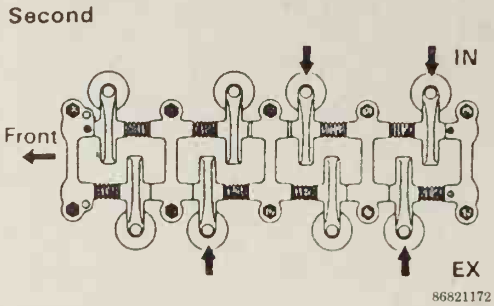

Fig. 139 Adjust the second set of valves the same as the first

14. Install the air cleaner with the hoses and duct work.
15. If still in place, remove the wrench and socket from the crankshaft pulley.

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➧ See Figures 140, 141, 142, 143, 144, 145, 146, 147, 148, 149 and 150

The valves should be checked with the engine cold. Generally, this means the vehicle has not been driven in at least 3 hours. Use a longer interval for hot climates. Overnight cold is best.

➡ The use of valve shim removing tools and a micrometer is required for this procedure. Toyota lists both shim removing tools as a set, SST 09248-55010; equivalent tools may be purchased through retail outlets. A micrometer is a precision measuring device. Do not attempt the procedure if the tools are not available.

1. Disconnect the spark plug wires, then remove the plugs.
2. Remove the air intake chamber by tagging and disconnecting:
   a. The throttle position sensor.
   b. The canister vacuum hose from the throttle body.
   c. The vacuum and fuel hoses from the pressure regulator.
   d. The PCV hose at the union.
   e. The No. 4 water by-pass hose from the union of the intake manifold.
   f. The No. 5 water by-pass hose from the water by-pass pipe.
   g. The cold start injector wire.
   h. The vacuum hose at the fuel filter.
   i. Remove the union bolt and two gaskets and then remove the cold start injector tube.
   j. The EGR gas temperature sensor wire.
   k. The EGR vacuum hoses at the air pipe and vacuum modulator.
   l. On California vehicles, remove the EGR gas sensor connector.
   m. Remove the nut, bolt and intake chamber stay.

n. Remove the 5 nuts, EGR valve with the pipes still connected and the 2 gaskets.

o. Disconnect the No. 1 air hose at the reed valve.

p. Remove the six bolts and two nuts and lift off the air intake chamber and gasket.

3. Disconnect the following wiring:
   a. Knock sensor
   b. No. 2 water temperature switch
   c. Start injector time switch
   d. Water temperature switch
   e. Right side ground strap
   f. Injector connectors.
4. After the connectors are removed, unfasten the two bracket bolts and move the engine wire harness to an out of the way location.
5. Remove the left and right valve covers (cylinder head covers).
6. Use a wrench and turn the crankshaft clockwise until the notch in the pulley aligns with the timing mark **0** of the lower (No. 1) timing belt cover.

➡Check that the valve lifters on the No. 1 cylinder are loose and those on No. 4 cylinder are tight. If not, turn the crankshaft one complete revolution clockwise and realign the marks.

7. Using a flat feeler gauge, measure the clearance between the bottom of the camshaft lobe and the top surface of the valve lifter (It is the top surface of the shim). This measurement should correspond to the one given in the Tune-Up Specifications chart. Check only the No. 6 intake valve and the No. 2 exhaust valve.

➡If the measurement is within specifications, go on to the next step. If not, record the measurement taken for each individual valve. They will be used later to determine the required replacement shim sizes.

8. Turn the crankshaft ⅓ of a revolution (120°). One-third revolution is the equivalent of from 12 to 4 on a clock face. The No. 1 intake and the No. 3 exhaust valves should not be under tension from the cam lobes. Measure the clearances for these 2 valves only. Record any measurement that is out of specification.
9. Turn the crankshaft ⅓ of a revolution (120°) and measure the clearance at the No. 2 intake and the No. 4 exhaust valves. Record any measurement that is out of specification.
10. Turn the crankshaft ⅓ of a revolution (120°) and measure the clearance at the No. 3 intake and the No. 5 exhaust valves. Record any measurement that is out of specification.
11. Turn the crankshaft ⅓ of a revolution (120°) and measure the clearance at the No. 4 intake and the No. 6 exhaust valves. Record any measurement that is out of specification.
12. Turn the crankshaft ⅓ of a revolution (120°) and measure the clearance at the No. 5 intake and the No. 1 exhaust valves. Record any measurement that is out of specification.

➡If the measurements for the six sets of valves are within specifications, you need go no further; the procedure is finished. If any clearance is not within specification, continue with the next step.

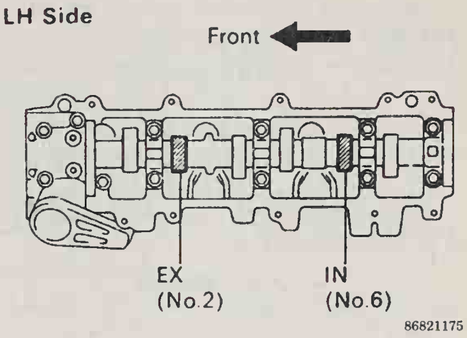


Fig. 140 Check the clearance of the left side intake No. 6 and exhaust No. 2 valves

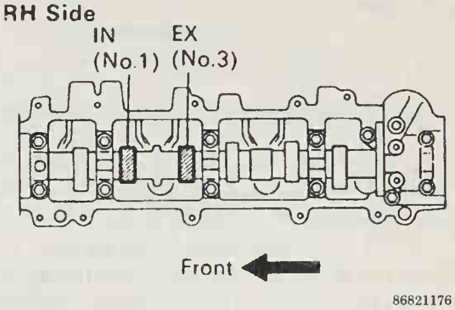


Fig. 141 Check the clearance of the right side intake No. 1 and exhaust No. 3 valves

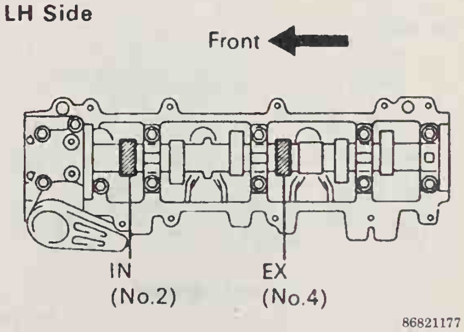


Fig. 142 Check the clearance of the left side intake No. 2 and exhaust No. 4 valves

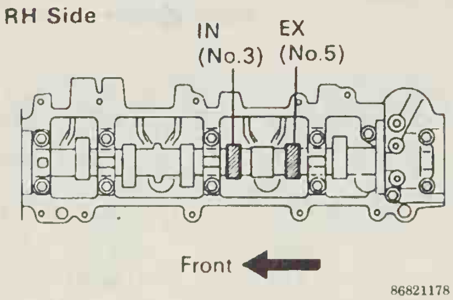


Fig. 143 Check the clearance of the right side intake No. 3 and exhaust No. 5 valves

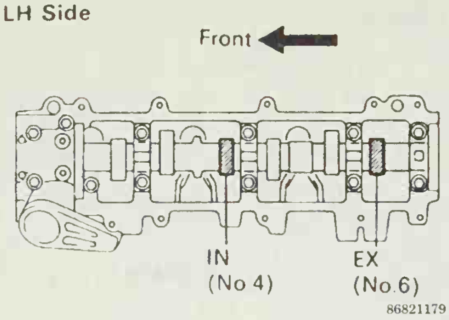


Fig. 144 Check the clearance of the left side intake No. 4 and exhaust No. 6 valves

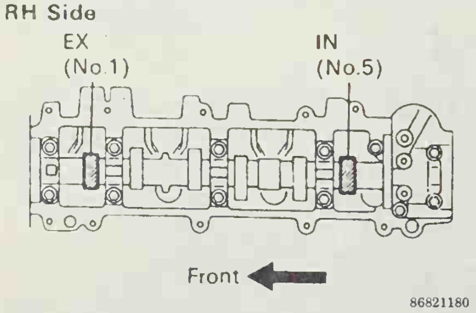


Fig. 145 Check the clearance of the right side intake No. 5 and exhaust No. 1 valves

13. Turn the crankshaft clockwise until the camshaft lobe of the valve to be adjusted faces upward, taking tension off the valve.
14. Using a small awl, turn the valve lifter so that the notch is easily accessible.
15. Install the SST 09248-05410 (A) or its equivalent scissors-type tool on the lifter, then squeeze the handle so that the tool presses down the valve lifter evenly. Hold the valve lifter down with the other SST 09248-05420 (B) or its equivalent single-bladed tool. Remove tool (A) or equivalent.

➡For easy removal of the shim, set the SST (B) or equivalent on the lifter so there is adequate space in the removal direction.

16. Using a small flatbladded tool and a magnet, remove the valve shim.
17. Carefully measure the thickness of the old shim with a micrometer. Locate that particular measurement in the "Installed Shim Thickness" column of the accompanying charts, then locate the recorded clearance measurement (from Step

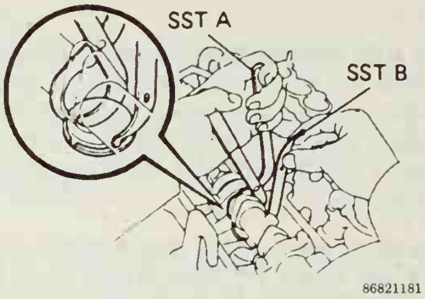


Fig. 146 Using tool (A), press down the valve lifter, then place tool (B) between the camshaft and the valve lifter

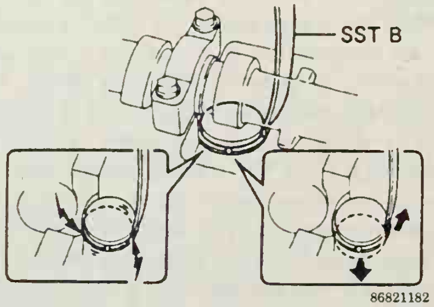


Fig. 147 When setting tool (B) or its equivalent, set it on the lifter so there is a wide space in the removal direction

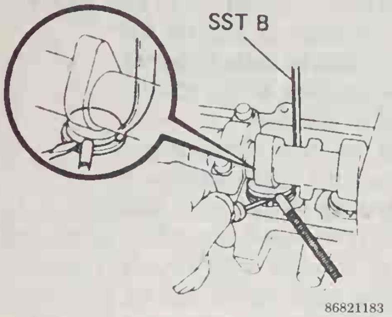


Fig. 148 With the aid of a magnet and a small flatbladded tool, remove the shim

6-11) for that valve in the "Measured Clearance " column of the charts. Index the two columns to arrive at the proper replacement shim thickness.

➡Replacement shims are available in 25 sizes, in increments of 0.002 in. (0.05mm), from 0.0866 in. (2.200mm) to 0.133 in. (3.400mm).

18. Install the new shim, remove the special tool and then recheck the valve clearance.
19. Consult the clearances recorded earlier and perform Steps 12-17 for any other valve needing adjustment. Always turn the engine clockwise as you face the front of the motor.
20. Install the spark plugs.
21. Install the valve covers. Place the gasket on the cover and install small amounts of sealant. Attach the covers, then tighten the 11 bolts only to 4-5 ft. lbs. (5-7 Nm). Do not overtighten.
22. Install the engine wire harness with the two bolts. Attach every connector removed in Step 2.

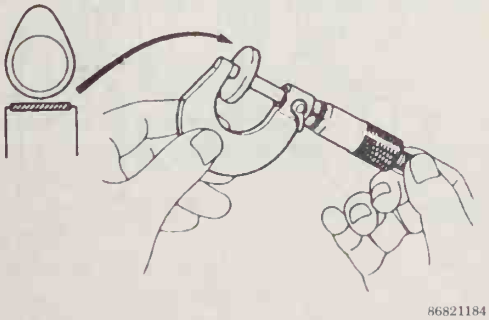


Fig. 149 A micrometer is used to measure the thickness of shims

23. Place a new gasket on the intake manifold. Install the air intake chamber with the 6 bolts and 2 nuts. Tighten them evenly to 13 ft. lbs. (18 Nm).
24. Connect the No.1 air hose to the reed valve.
25. Place two new gaskets on the intake chamber and right-side exhaust chamber. Install the EGR valve with the pipes to the intake chamber and manifold.
26. Install the air intake chamber stay. Refer to the illustration for bolt designation. Tighten bolts (A) to 22 ft. lbs. (29 Nm). Tighten bolts (B) to 13 ft. lbs. (18 Nm).
27. Connect the EGR hoses to the air pipe and the vacuum modulator. On California vehicles, connect the EGR temperature sensor connector.
28. Use a new gasket and install the cold start injector; tighten the union (banjo) bolt to 13 ft. lbs. (18 Nm).
29. Install the vacuum hose to the fuel filter and connect the cold start injector wiring connector.
30. Install the No. 5 water by-pass hose to the water bypass pipe. Connect the No. 4 water bypass hose to the union at the intake manifold.
31. Connect the PCV hose. Connect the vacuum and fuel hoses to the pressure regulator.
32. Connect the canister vacuum hose to the throttle body.
33. Attach the wiring connector to the throttle body.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 151, 152, 153, 154 and 155

➡Adjust the valve clearance when the engine is cold.

1. Disconnect the negative battery cable.
2. Remove the cylinder head covers.
3. Turn the crankshaft pulley and align its groove with the timing mark **0** of the No. 1 timing cover.
4. Check that the timing marks on the camshaft sprockets are in alignment with the marks on the No. 4 timing cover. If not, turn the crankshaft 1 complete revolution (360°).
5. Measure the clearance between the valve lifter and the camshaft. Record the measurements on the intake valves No. 1 and 2. Measure the exhaust valves at the 1 and 3.
    a. The intake valve clearance cold is 0.006-0.010 in. (0.15-0.25mm).

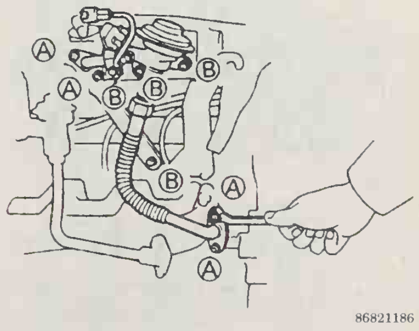


Fig. 150 Tighten bolts (A) to 22 ft. lbs. (29 Nm) and (B) to 13 ft. lbs. (18 Nm)

b. The exhaust valve clearance cold is 0.010-0.014 in. (0.25-0.35mm).

6. Turn the crankshaft pulley 1 revolution (360°) and align the groove with the timing mark **0** of the No. 1 timing belt cover.

7. Measure the clearance between the valve lifter and the camshaft. Record the measurements on the intake valves No. 3 and 4. Measure the exhaust valves at the 2 and 4.

a. The intake valve clearance cold is 0.006-0.010 in. (0.15-0.25mm).

b. The exhaust valve clearance cold is 0.010-0.014 in. (0.25-0.35mm).

8. To adjust the intake valve clearance:

a. Remove the intake camshaft.

b. Using a small flatbladded tool and a magnet, remove the adjusting shim.

c. Determine the replacement adjusting shim size by either using the chart or the following formula:

- Intake — N=T+(A-0.008 in./0.20mm)
- Exhaust — N=T+(A-0.013 in./0.32mm)
- T=Thickness of removed shim
- A=Measured valve clearance
- N=Thickness of new shim

d. Install a new shim.

e. Install the intake camshaft.

f. Recheck the valve clearance.

9. To adjust the exhaust valve clearance:

a. Turn the crankshaft to position on the cam lobe of the camshaft on the valve to be adjusted, upward.

b. Turn the valve lifter so that the notch is perpendicular to the camshaft and facing the spark plug side.

c. Using SST 09248-55040 (valve lifter press) or equivalent, hold the camshaft in place.

d. Using SST 09248-55040 (valve lifter press) or equivalent, press down the valve lifter and place the SST

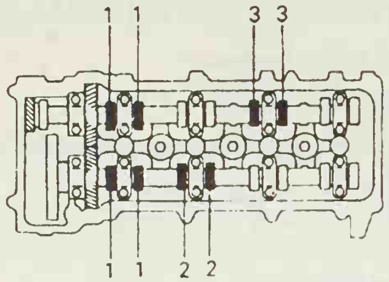


Fig. 151 Intake valves No. 1 and 2 and exhaust valves No. 1 and 3

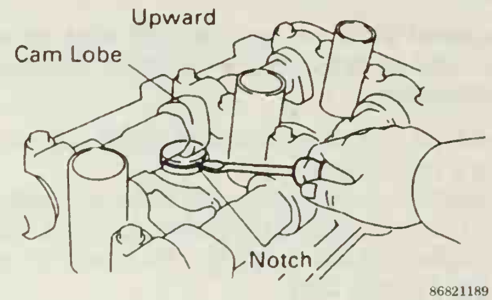


Fig. 153 Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward

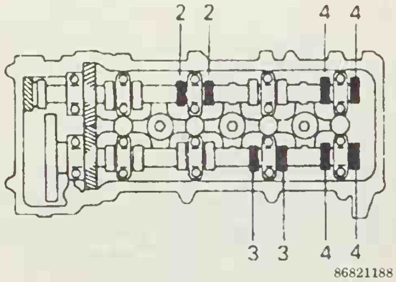


Fig. 152 Intake valves No. 3 and 4 and exhaust valves No. 2 and 4

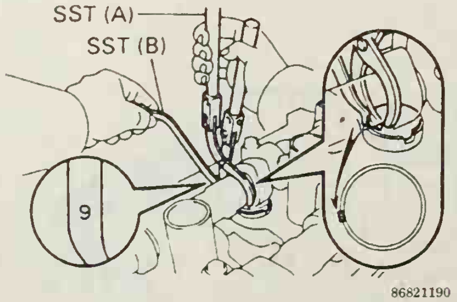


Fig. 154 Apply the SST (B) at a slight angle on the side marked with a "9", at the position shown in the illustration

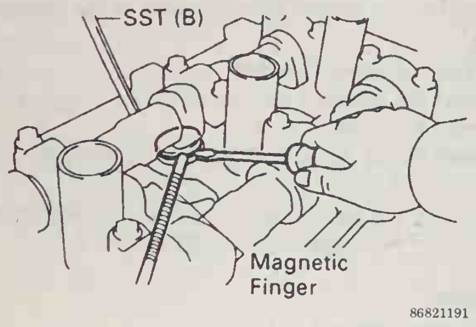


Fig. 155 Remove the adjusting shim with a small flatbladded tool and a magnet

09248-05420 (valve lifter stopper) or equivalent between the camshaft and the valve lifter.

e. Remove the tool 09248-44040 or equivalent.

f. Using a small bladed tool and a magnet, remove the adjusting shim.

10. Determine the replacement adjusting shim size by either using the chart or the following formula:

- Intake — $N=T+(A-0.008\text{ in.}/0.20\text{mm})$
- Exhaust — $N=T+(A-0.013\text{ in.}/0.32\text{mm})$
- T=Thickness of removed shim
- A=Measured valve clearance
- N=Thickness of new shim

11. Install a new shim.
12. Install the intake camshaft.
13. Recheck the valve clearance.
14. Install the cylinder head covers.
15. Connect the negative battery cable.

5VZ-FE Engine

▸ See Figures 156, 157, 158 and 159

➡Adjust the valves when the engine is cold.

1. Disconnect the negative battery cable.
2. Disconnect the throttle cable from the linkage.
3. Remove the air cleaner cover, air flow meter, and the air duct assemblies.
4. Remove the V-bank cover.
5. Remove the emission control valve set.
6. Remove the air intake chamber.
7. Disconnect the engine harness from the injectors and the ignition coils.
8. Detach the ignition coils and keep them in order for reassembly.
9. Remove the spark plugs.
10. Remove the cylinder head covers.
11. Turn the crankshaft pulley and align its groove with the timing mark **0** of the No. 1 timing cover.
12. Check that the valve lifters on the No. 1 intake are loose and the No. 1 exhaust are tight. If not, turn the crankshaft one complete revolution (360°).

➡All measurements should be written down. These recorded measurements will need to be used in conjunction with a mathematical formula to determine the thickness of the replacement shims.

13. Measure the clearance between the valve lifters and the camshaft. Record the measurements on valves No. 1 and 6 intake; 2 and 3 exhaust.
    a. The intake valve clearance cold is 0.006-0.009 in. (0.15-0.23mm).
    b. The exhaust valve clearance cold is 0.011-0.014 in. (0.25-0.37mm).
14. Turn the crankshaft ⅔ of a revolution (240°). Record the measurements on valves No. 2 and 3 intake; 4 and 5 exhaust.
15. Turn the crankshaft another ⅔ of a revolution (240°). Record the measurements on valves No. 4 and 5 intake; 1 and 6 exhaust.

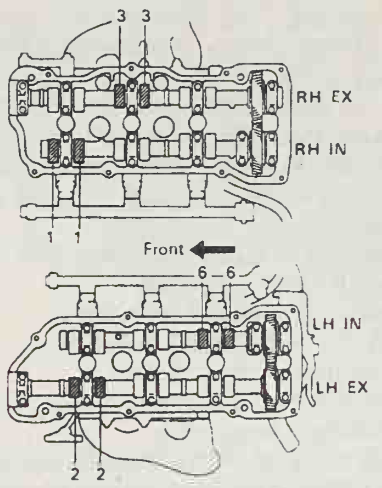


Fig. 156 Adjust these valves in the 1st step

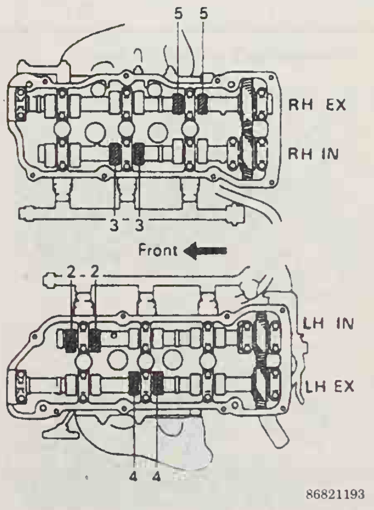
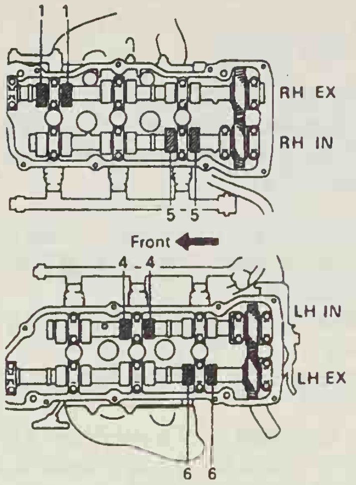


Fig. 157 Adjust these valves in the 2nd step



86821194

Fig. 158 Adjust these valves in the 3rd step

16. Remove the adjusting shim by turning the crankshaft to position the cam lobe of the camshaft in the up position on the valve to be adjusted. Using a small thin flatbladded tool, turn the valve lifters so that the notches are perpendicular to the camshaft. Press down the valve lifter with SST 09248-55010 (A) or equivalent. Place SST 09248-55010 (B) or equivalent, between the camshaft and the valve lifter. Remove part (A).

17. Remove the adjusting shim with a magnet and a small flatbladded tool.

18. Determine the replacement adjusting shim size by either using charts or the following formula:

- Intake — N=T+(A-0.008 in./0.20mm)
- Exhaust — N=T+(A-0.013 in./0.32mm)
- T=Thickness of removed shim
- A=Measured valve clearance
- N=Thickness of new shim

19. Select a new shim with the thickness as close as possible to the calculated value. Install the new replacement shim.

➡Shims are available in 17 sizes in increments of 0.0020 in. (0.050mm) from 0.06984 in. (2.500mm) to 0.1299 in. (3.300mm).

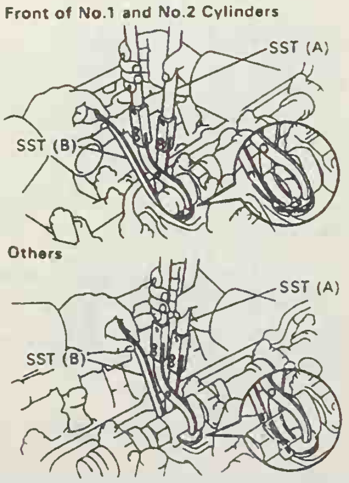


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Fig. 159 Removing the adjusting shims

20. Recheck the valve clearance.
21. Install the cylinder head covers.
22. Install the spark plugs and the ignition coils.
23. Connect the engine wiring harness to the injectors and the coils.
24. Install the intake chamber.
25. Install the emission control valve set.
26. Install the V-bank cover.
27. Install the air flow meter, air duct, and the air cleaner cover.
28. Connect the accelerator cable to the throttle linkage.
29. Connect the negative battery cable.

3F-E Engine

➧ See Figures 160 and 161

1. Start the engine and allow it to reach normal operating temperature.

2. Stop the engine. Remove any cables, hoses, wires, etc., which are attached to the valve cover and remove the valve cover.

⁂CAUTION

Components will be hot. The cylinder head, block and radiator will be very hot.

3. Use a wrench to turn the crankshaft pulley bolt clockwise until the timing marks are aligned at 0. Since the timing marks are at the back of the engine, an assistant is useful.

4. Once the timing marks are aligned, check the two rocker arms (No. 1) closest to the front of the motor; they should be loose. The No. 6 rocker arms should be tight. If not, rotate the engine one full rotation (360°) and realign the timing marks at 0.

5. Check the clearance between each of the rocker arms and valve stems for the first set of valves, as shown, using a feeler gauge. Hot the intake should be 0.008 in. (0.20mm) and exhaust 0.014 in. (0.35mm).

6. If the clearance is incorrect, loosen the locknut and turn the adjusting screw as required to gain correct clearance. The feeler gauge should pass with just the slightest drag. Tighten the locknut and recheck the clearance.

7. When all valves in the first set are adjusted, turn the crankshaft one full rotation clockwise. The two rockers closest to the firewall or back of the motor should be loose. Repeat the measuring and adjusting procedure for each valve in the second set, as shown.

8. After adjusting all of the valves, install a new valve cover gasket on the cover. Install the valve cover, tightening the bolts to 6 ft. lbs. (8 Nm). Install any other components which were removed during Step 2. Make certain all wires and cables are properly held by the clamps or brackets.

9. Recheck the engine idle speed and adjust if necessary.

1FZ-FE Engine

➧ See Figures 162, 163, 164, 165, 166 and 167

➡Adjust the valves when the engine is cold.

1. Drain the engine coolant from the vehicle.
2. Remove the throttle body:
   a. Disconnect the PCV hose.

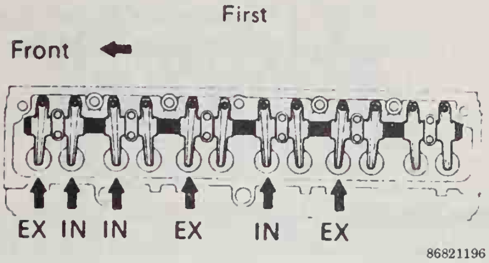

Fig. 160 Adjust the first set of valves to specifications

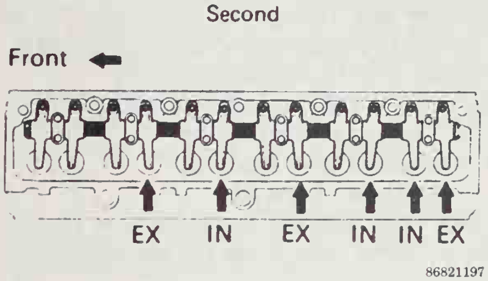

Fig. 161 The second set of valves can be a adjusted after the first set is checked

b. Detach the air cleaner hose.
c. Disconnect the control cables from the throttle body.
d. Remove the throttle position sensor connection.
e. Disconnect the idle air control valve wiring.

3. Disconnect the engine wiring harness and heater valve from the cowl panel.
4. Tag and disconnect the spark plug wires.
5. Remove the valve cover.
6. Set the No. 1 cylinder to TDC/compression stroke by turning the crankshaft pulley, and aligning its groove with the timing mark **0** of the timing chain cover.
7. Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in a straight line on the cylinder head surface. If they are not, turn the crankshaft 1 revolution (360°) and align the marks.
8. Inspect the valve clearance by using a thickness gauge. Measure the clearance between the valve lifter and the camshaft.
9. Record the out of specification valve clearance measurements. These will be used later to determine the replacement

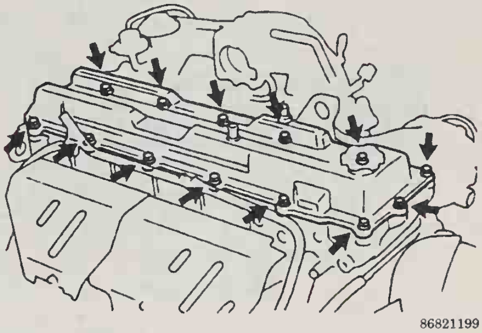

Fig. 162 Remove the valve cover

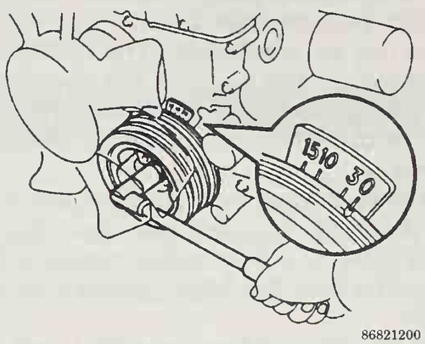

Fig. 163 Turn the crankshaft pulley, and align its groove with the 0 mark of the timing chain cover

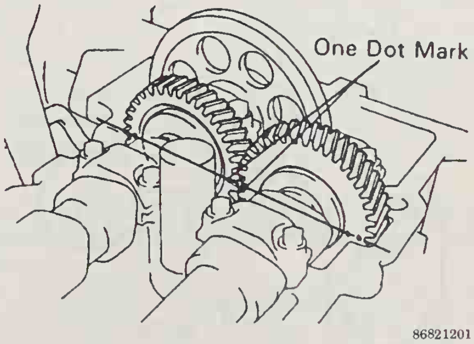

Fig. 164 Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in a straight line on the cylinder head surface

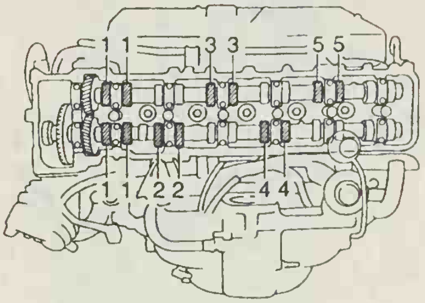

Fig. 165 Check these valves first

adjusting shims. Intake is 0.006-0.010 in. (0.15-0.25mm) and exhaust is 0.010-0.014 in. (0.25-0.35mm).

10. Turn the crankshaft pulley 1 revolution (360°) and align its groove with the timing mark **0**.

11. Check only the valves shown in the first illustration.

12. Adjust the clearance except for rear valves of the No. 6 cylinder. Remove the adjusting shim by turning the crankshaft to position the cam lobe of the camshaft on thew adjusting valve upward.

13. Position the notch of the valve lifter toward the spark plug side. Using SST (A) or equivalent, press down the valve lifter and place the SST (B) or equivalent between the camshaft and the valve lifter flange. Remove the SST (A) or its equivalent.

14. Apply SST (B) or equivalent at a slight angle on the side marked with "11", at the position shown in thew illustration.

15. When the SST (B) or equivalent are inserted too deeply, it will get pinched by the shim. To prevent this from occurring, insert it shallowly from the outside of the cylinder head, at a slight angle.

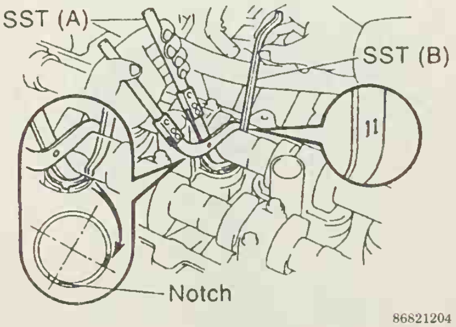

Fig. 166 Note the area of the mark "11", this is where you will apply the SST (B) or its equivalent

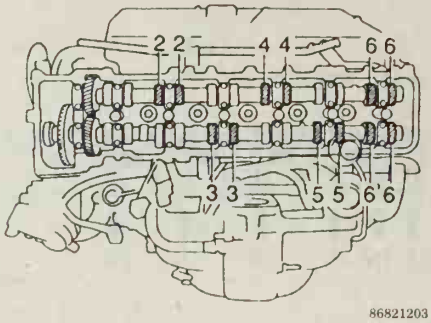

Fig. 167 Adjust the valve clearance for the second set

16. Remove the adjusting shim with a small flatbladded tool and a magnet.

17. Determine the replacement shim size by following the formula or charts. Using a micrometer, measure the thickness of the removed shim. Calculate the thickness of the new shim so that the valve clearance comes within specifications.

- Intake — N=T+(A-0.008 in./0.20mm)
- Exhaust — N=T+(A-0.013 in./0.32mm)
- T=Thickness of removed shim
- A=Measured valve clearance
- N=Thickness of new shim

18. Select a new shim with the thickness as close as possible to the calculated value. Install the new replacement shim.

➡Shims are available in 17 sizes in increments of 0.0020 in. (0.050mm) from 0.06984 in. (2.500mm) to 0.1299 in. (3.300mm).

19. Install a new adjusting shim. Place the new shim on the valve lifter. Using SST (A) 09248-06020 or equivalent, press down on the valve lifter and remove the SST (B) 09248-55050 or equivalent.

20. Recheck the valve clearance.

21. For the rear valves of cylinder No. 6, remove the distributor.

22. Remove the camshafts.

23. Remove the adjusting shim with a small flatbladded tip.

24. Determine the replacement adjusting shim size by following the formula or charts.

25. Using a micrometer, measure the thickness of the removed shim. Calculate the thickness of the new shim so that the valve clearance comes within specifications.

- Intake — N=T+(A-0.008 in./0.20mm)
- Exhaust — N=T+(A-0.013 in./0.32mm)
- T=Thickness of removed shim
- A=Measured valve clearance
- N=Thickness of new shim

26. Select a new shim with the thickness as close as possible to the calculated value. Install the new replacement shim.

➡Shims are available in 17 sizes in increments of 0.0020 in. (0.050mm) from 0.06984 in. (2.500mm) to 0.1299 in. (3.300mm).

27. Install a new adjusting shim. Place the new shim on the valve lifter.
28. Install the camshafts, then recheck the valve clearance.
29. Install the distributor.
30. Install the valve cover using gasket sealant.
31. Attach the spark plug wires to the plugs.
32. Reconnect the heater valve and the engine wire to the cowl.
33. Reinstall the throttle body.
34. Refill the radiator with engine coolant and water mixture.
35. Check and adjust the timing. Check for coolant leaks.

Idle Speed And Mixture Adjustments

MIXTURE ADJUSTMENT

To meet emissions regulations, the mixture adjusting screw on the carbureted 22R engine is preadjusted and plugged by Toyota. Adjusting this screw is not part of routine maintenance. Access to the screw requires removal of the carburetor. Full details of re-setting the air/fuel mixture after a carburetor overhaul are covered in Section 5. In virtually all cases, the air/fuel mixture screw is NOT the cause of a problem. Even if the engine is tested with an emissions analyzer, incorrect mixture is almost always caused by air leaks in the system or faulty internal carburetor parts (clogged jets, mis-adjusted floats, etc.). We recommend all mixture adjustments be handled by a professional mechanic equipped with the proper emissions test equipment.

On the fuel injected engines, fuel mixture is handled by the computer, based on signals from the oxygen sensor in the exhaust system and many other engine sensors. By having a "picture" of the engine operating conditions at any given moment, the computer determines the exact amount of fuel to maintain proper combustion and signals the injectors accordingly. Any investigation of the air/fuel mixture on a fuel injected engine requires the use of an HC/CO emissions tester, which is well out of the reach of the home mechanic.

IDLE ADJUSTMENT

Carbureted Engines

Before attempting to set the idle speed, the following conditions must be met: Air cleaner installed with all ducts, hoses, etc. intact, engine fully warmed and choke plate open, all electric accessories switched OFF, all vacuum lines connected, transmission in NEUTRAL and parking brake set and engine running at normal temperature.

1. Connect a tachometer to the engine.
2. Set the curb idle speed by turning the adjusting screw on the side (not the bottom) of the carburetor. Correct idle speed is 700 rpm.
3. Turn the ignition **OFF**. Remove the air cleaner. Remove and plug the hoses for both the Hot Air Intake (HAI) and Mixture Control (MC) systems.
4. Disconnect the hose from the choke opener diaphragm and plug the hose end. This shuts off the choke opener system.
5. Disconnect the hose from the EGR valve.
6. Hold the throttle plate (in the bottom of the carburetor) slightly open and at the same time push the choke plate (top of the carb) closed. Hold the choke closed while releasing the throttle plate. This sounds tricky but is easily accomplished with a thin tool.
7. Start the engine but DO NOT touch the accelerator. The engine is running at high idle, as it would if started cold.
8. Set the fast idle speed by adjusting the lower screw on the carburetor. Correct idle speeds are: 49 State and Canada, 3000 rpm and California, 2600 rpm.
9. Turn the engine **OFF**. Remove the tachometer. Connect the vacuum hoses to the correct locations.
10. Install the air cleaner assembly.

Fuel Injected Engines

The idle speed on the fuel injected engines are electronically controlled by the Engine Control Module (ECM) computer. The Idle Speed Control (ISC) system electrically oversees the proper idle speed for all operating conditions. This is a good news/bad news arrangement. The bad news is that you can't adjust it; the good news is that it rarely, if ever, needs adjusting. Any roughness or uneven idle is almost always due to other causes such as a clogged injector, air leak or loose, corroded terminals in the wiring harness.

Air Conditioning

➡Be sure to consult the laws in your area before servicing the air conditioning system. In most areas, it is illegal to perform repairs involving refrigerant unless the work is done by a certified technician. Also, it is quite likely that you will not be able to purchase refrigerant without proof of certification.

SAFETY PRECAUTIONS

There are two major hazards associated with air conditioning systems and they both relate to the refrigerant gas. First, the refrigerant gas (R-12 or R-134a) is an extremely cold substance. When exposed to air, it will instantly freeze any surface it comes in contact with, including your eyes. The other hazard relates to fire (if your vehicle is equipped with R-12. Although normally non-toxic, the R-12 gas becomes highly poisonous in the presence of an open flame. One good whiff of the vapor formed by burning R-12 can be fatal. Keep all forms of fire (including cigarettes) well clear of the air conditioning system.

Because of the inherent dangers involved with working on air conditioning systems, these safety precautions must be strictly followed.

- Avoid contact with a charged refrigeration system, even when working on another part of the air conditioning system or vehicle. If a heavy tool comes into contact with a section of tubing or a heat exchanger, it can easily cause the relatively soft material to rupture.
- When it is necessary to apply force to a fitting which contains refrigerant, as when checking that all system couplings are securely tightened, use a wrench on both parts of the fitting involved, if possible. This will avoid putting torque on

refrigerant tubing. (It is also advisable to use tube or line wrenches when tightening these flare nut fittings.)

➡R-12 refrigerant is a chlorofluorocarbon which, when released into the atmosphere, can contribute to the depletion of the ozone layer in the upper atmosphere. Ozone filters out harmful radiation from the sun.

- Do not attempt to discharge the system without the proper tools. Precise control is possible only when using the service gauges and a proper A/C refrigerant recovery station. Wear protective gloves when connecting or disconnecting service gauge hoses.
- Discharge the system only in a well ventilated area, as high concentrations of the gas which might accidentally escape can exclude oxygen and act as an anesthetic. When leak testing or soldering, this is particularly important, as toxic gas is formed when R-12 contacts any flame.
- Never start a system without first verifying that both service valves are properly installed, and that all fittings throughout the system are snugly connected.
- Avoid applying heat to any refrigerant line or storage vessel. Charging may be aided by using water heated to less than 125°F (50°C) to warm the refrigerant container. Never allow a refrigerant storage container to sit out in the sun, or near any other source of heat, such as a radiator or heater.
- Always wear goggles to protect your eyes when working on a system. If refrigerant contacts the eyes, it is advisable in all cases to consult a physician immediately.
- Frostbite from liquid refrigerant should be treated by first gradually warming the area with cool water, and then gently applying petroleum jelly. A physician should be consulted.
- Always keep refrigerant drum fittings capped when not in use. If the container is equipped with a safety cap to protect the valve, make sure the cap is in place when the can is not being used. Avoid sudden shock to the drum, which might occur from dropping it, or from banging a heavy tool against it. Never carry a drum in the passenger compartment of a vehicle.
- Always completely discharge the system into a suitable recovery unit before painting the vehicle (if the paint is to be baked on), or before welding anywhere near refrigerant lines.
- When servicing the system, minimize the time that any refrigerant line or fitting is open to the air in order to prevent moisture or dirt from entering the system. Contaminants such as moisture or dirt can damage internal system components. Always replace O-rings on lines or fittings which are disconnected. Prior to installation coat, but do not soak, replacement O-rings with suitable compressor oil.

GENERAL SERVICING PROCEDURES

➡It is recommended, and possibly required by law, that a qualified technician perform the following services.

****WARNING**

Some of the vehicles covered by this manual may be equipped with R-134a refrigerant systems, rather than R-12. Be ABSOLUTELY SURE what type of system you are working on before attempting to add refrigerant. Use of the wrong refrigerant or oil will cause damage to the system.

The most important aspect of air conditioning service is the maintenance of a pure and adequate charge of refrigerant in the system. A refrigeration system cannot function properly if a significant percentage of the charge is lost. Leaks are common because the severe vibration encountered underhood in an automobile can easily cause a sufficient cracking or loosening of the air conditioning fittings; allowing, the extreme operating pressures of the system to force refrigerant out.

The problem can be understood by considering what happens to the system as it is operated with a continuous leak. Because the expansion valve regulates the flow of refrigerant to the evaporator, the level of refrigerant there is fairly constant. The receiver/drier stores any excess refrigerant, and so a loss will first appear there as a reduction in the level of liquid. As this level nears the bottom of the vessel, some refrigerant vapor bubbles will begin to appear in the stream of liquid supplied to the expansion valve. This vapor decreases the capacity of the expansion valve very little as the valve opens to compensate for its presence. As the quantity of liquid in the condenser decreases, the operating pressure will drop there and throughout the high side of the system. As the refrigerant continues to be expelled, the pressure available to force the liquid through the expansion valve will continue to decrease, and, eventually, the valve's orifice will prove to be too much of a restriction for adequate flow even with the needle fully withdrawn.

At this point, low side pressure will start to drop, and a severe reduction in cooling capacity, marked by freeze-up of the evaporator coil, will result. Eventually, the operating pressure of the evaporator will be lower than the pressure of the atmosphere surrounding it, and air will be drawn into the system wherever there are leaks in the low side.

Because all atmospheric air contains at least some moisture, water will enter the system mixing with the refrigerant and oil. Trace amounts of moisture will cause sludging of the oil, and corrosion of the system. Saturation and clogging of the filter/drier, and freezing of the expansion valve orifice will eventually result. As air fills the system to a greater and greater extent, it will interfere more and more with the normal flows of refrigerant and heat.

From this description, it should be obvious that much of the repairman's focus in on detecting leaks, repairing them, and then restoring the purity and quantity of the refrigerant charge. A list of general rules should be followed in addition to all safety precautions:

- Keep all tools as clean and dry as possible.
- Thoroughly purge the service gauges/hoses of air and moisture before connecting them to the system. Keep them capped when not in use.
- Thoroughly clean any refrigerant fitting before disconnecting it, in order to minimize the entrance of dirt into the system.
- Plan any operation that requires opening the system beforehand, in order to minimize the length of time it will be exposed to open air. Cap or seal the open ends to minimize the entrance of foreign material.

- When adding oil, pour it through an extremely clean and dry tube or funnel. Keep the oil capped whenever possible. Do not use oil that has not been kept tightly sealed.
- Purchase refrigerant intended for use only in automatic air conditioning systems.
- Completely evacuate any system that has been opened for service, or that has leaked sufficiently to draw in moisture and air. This requires evacuating air and moisture with a good vacuum pump for at least one hour. If a system has been open for a considerable length of time it may be advisable to evacuate the system for up to 12 hours (overnight).
- Use a wrench on both halves of a fitting that is to be disconnected, so as to avoid placing torque on any of the refrigerant lines.
- When overhauling a compressor, pour some of the oil into a clean glass and inspect it. If there is evidence of dirt, metal particles, or both, flush all refrigerant components with clean refrigerant before evacuating and recharging the system. In addition, if metal particles are present, the compressor should be replaced.
- Schrader valves may leak only when under full operating pressure. Therefore, if leakage is suspected but cannot be located, operate the system with a full charge of refrigerant and look for leaks from all Schrader valves. Replace any faulty valves.

Additional Preventive Maintenance

USING THE SYSTEM

The easiest and most important preventive maintenance for your A/C system is to be sure that it is used on a regular basis. Running the system for five minutes each month (no matter what the season) will help assure that the seals and all internal components remain lubricated.

ANTIFREEZE

▸ See Figure 168

In order to prevent heater core freeze-up during A/C operation, it is necessary to maintain a proper antifreeze protection. Use a hand-held antifreeze tester (hydrometer) to periodically check the condition of the antifreeze in your engine's cooling system.

➡Antifreeze should not be used longer than the manufacturer specifies.

RADIATOR CAP

For efficient operation of an air conditioned vehicle's cooling system, the radiator cap should have a holding pressure which meets manufacturer's specifications. A cap which fails to hold these pressures should be replaced.

CONDENSER

Any obstruction of or damage to the condenser configuration will restrict the air flow which is essential to its efficient operation. It is therefore a good rule to keep this unit clean and in proper physical shape.

➡Bug screens which are mounted in front of the condenser (unless they are original equipment) are regarded as obstructions.

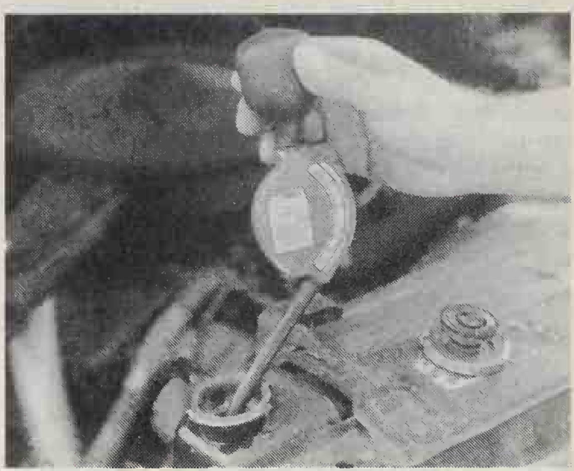

Fig. 168 An antifreeze tester can be use to determine the condition of the coolant in your vehicle

CONDENSATION DRAIN TUBE

This single molded drain tube expels the condensation, which accumulates on the bottom of the evaporator housing, into the engine compartment. If this tube is obstructed, the air conditioning performance can be restricted and condensation buildup can spill over onto the vehicle's floor.

SYSTEM INSPECTION

➡R-12 refrigerant is a chlorofluorocarbon which, when released into the atmosphere, can contribute to the depletion of the ozone layer in the upper atmosphere. Ozone filters out harmful radiation from the sun.

The easiest and often most important check for the air conditioning system consists of a visual inspection of the system components. Visually inspect the air conditioning system for refrigerant leaks, damaged compressor clutch, compressor drive belt tension and condition, plugged evaporator drain tube, blocked condenser fins, disconnected or broken wires, blown fuses, corroded connections and poor insulation.

A refrigerant leak will usually appear as an oily residue at the leakage point in the system. The oily residue soon picks up dust or dirt particles from the surrounding air and appears greasy. Through time, this will build up and appear to be a heavy dirt impregnated grease. Most leaks are caused by damaged or missing O-ring seals at the component connections, damaged charging valve cores or missing service gauge port caps.

For a thorough visual and operational inspection, check the following:

1. Check the surface of the radiator and condenser for dirt, leaves or other material which might block air flow.
2. Check for kinks in hoses and lines. Check the system for leaks.
3. Make sure the drive belt is under the proper tension. When the air conditioning is operating, make sure the drive belt is free of noise or slippage.

4. Make sure the blower motor operates at all appropriate positions, then check for distribution of the air from all outlets with the blower on **HIGH**.

➡Keep in mind that under conditions of high humidity, air discharged from the A/C vents may not feel as cold as expected, even if the system is working properly. This is because the vaporized moisture in humid air retains heat more effectively than does dry air, making the humid air more difficult to cool.

5. Make sure the air passage selection lever is operating correctly. Start the engine and warm it to normal operating temperature, then make sure the hot/cold selection lever is operating correctly.

DISCHARGING, EVACUATING AND CHARGING

Discharging, evacuating and charging the air conditioning system must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards for the type of system to be serviced.

If you don't have access to the necessary equipment, we recommend that you take your vehicle to a reputable service station to have the work done. If you still wish to perform repairs on the vehicle, have them discharge the system, then take your vehicle home and perform the necessary work. When you are finished, return the vehicle to the station for evacuation and charging. Just be sure to cap ALL A/C system fittings immediately after opening them and keep them protected until the system is recharged.

Windshield Wipers

ELEMENT (REFILL) CARE AND REPLACEMENT

➧ See Figures 169, 170, 171, 172, 173, 174, 175, 176, 177, 178 and 179

For maximum effectiveness and longest element life, the windshield and wiper blades should be kept clean. Dirt, tree sap, road tar and so on will cause streaking, smearing and blade deterioration if left on the glass. It is advisable to wash the windshield carefully with a commercial glass cleaner at least once a month. Wipe off the rubber blades with the wet rag afterwards. Do not attempt to move wipers across the windshield by hand; damage to the motor and drive mechanism will result.

To inspect and/or replace the wiper blade elements, place the wiper switch in the **LOW** speed position and the ignition switch in the **ACC** position. When the wiper blades are approximately vertical on the windshield, turn the ignition switch to **OFF**.

Examine the wiper blade elements. If they are found to be cracked, broken or torn, they should be replaced immediately. Replacement intervals will vary with usage, although ozone deterioration usually limits element life to about one year. If the wiper pattern is smeared or streaked, or if the blade chatters across the glass, the elements should be replaced. It is easiest and most sensible to replace the elements in pairs.

If your vehicle is equipped with aftermarket blades, there are several different types of refills and your vehicle might have any kind. Aftermarket blades and arms rarely use the exact same type blade or refill as the original equipment. Here are some typical aftermarket blades; not all may be available for your vehicle:

The Anco® type uses a release button that is pushed down to allow the refill to slide out of the yoke jaws. The new refill slides back into the frame and locks in place.

Some Trico® refills are removed by locating where the metal backing strip or the refill is wider. Insert a small screwdriver blade between the frame and metal backing strip. Press down to release the refill from the retaining tab.

Other types of Trico® refills have two metal tabs which are unlocked by squeezing them together. The rubber filler can then be withdrawn from the frame jaws. A new refill is installed by inserting the refill into the front frame jaws and sliding it rearward to engage the remaining frame jaws. There are usually four jaws; be certain when installing that the refill is engaged in all of them. At the end of its travel, the tabs will lock into place on the front jaws of the wiper blade frame.

Another type of refill is made from polycarbonate. The refill has a simple locking device at one end which flexes downward out of the groove into which the jaws of the holder fit, allowing easy release. By sliding the new refill through all the jaws and pushing through the slight resistance when it reaches the end of its travel, the refill will lock into position.

To replace the Tridon® refill, it is necessary to remove the wiper blade. This refill has a plastic backing strip with a notch about 1 in. (25mm) from the end. Hold the blade (frame) on a hard surface so that the frame is tightly bowed. Grip the tip of the backing strip and pull up while twisting counterclockwise. The backing strip will snap out of the retaining tab. Do this for the remaining tabs until the refill is free of the blade. The length of these refills is molded into the end and they should be replaced with identical types.

Regardless of the type used, be sure to follow the part manufacturer's instructions closely. Make sure that all of the frame jaws are engaged as the refill is placed and locked. If the metal blade holder and frame are allowed to touch the glass during wiper operation, the glass will be scratched.

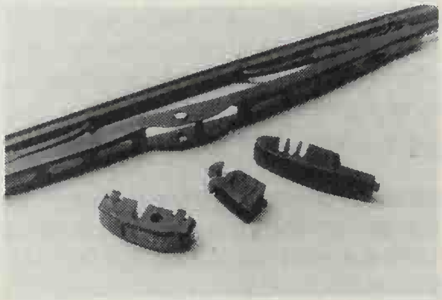

Fig. 169 Bosch® wiper blade and fit kit

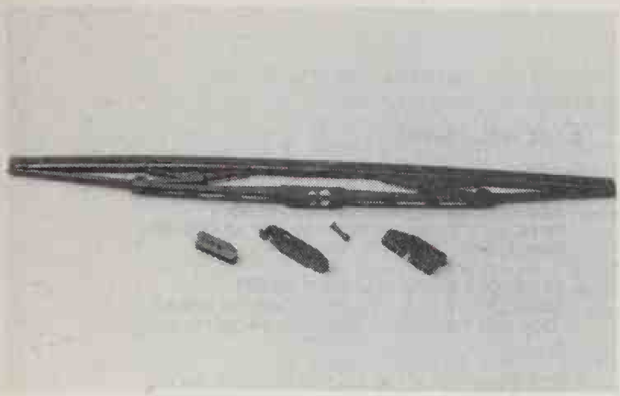
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Fig. 170 Lexor® wiper blade and fit kit

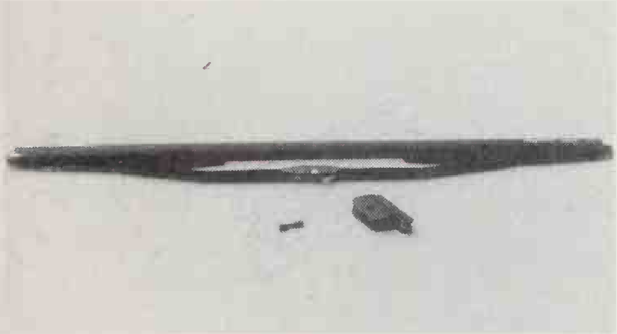
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Fig. 171 Pylon® wiper blade and adaptor

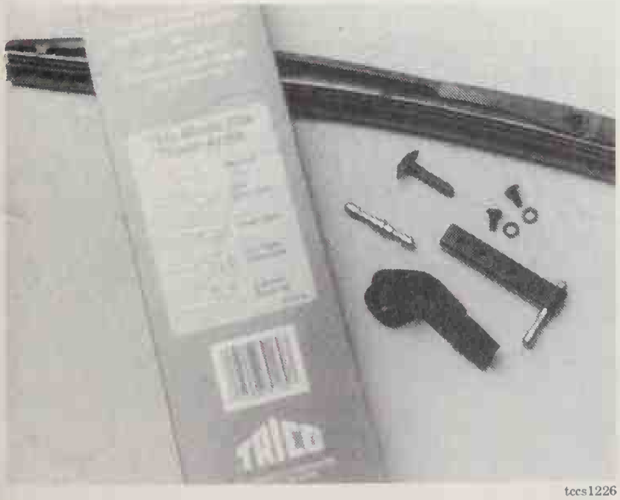

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Fig. 172 Trico® wiper blade and fit kit

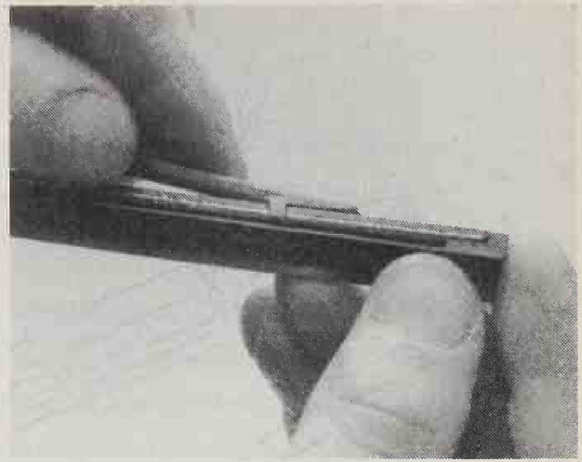
tccs1228

Fig. 173 To remove and install a Lexor® wiper blade refill, slip out the old insert and slide in a new one

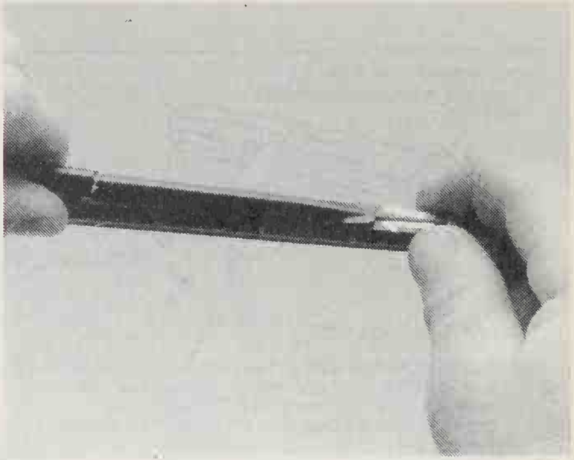
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Fig. 174 On Pylon® inserts, the clip at the end has to be removed prior to sliding the insert off

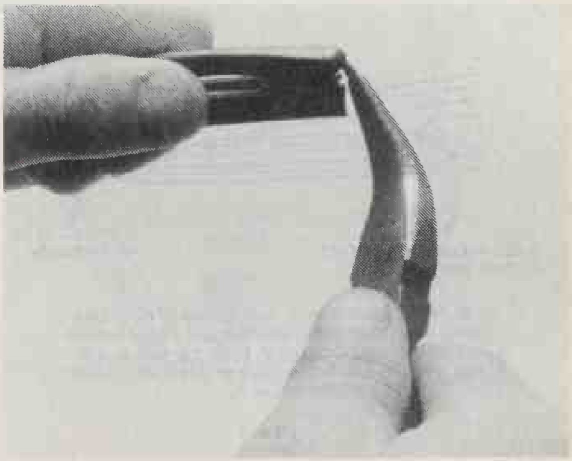
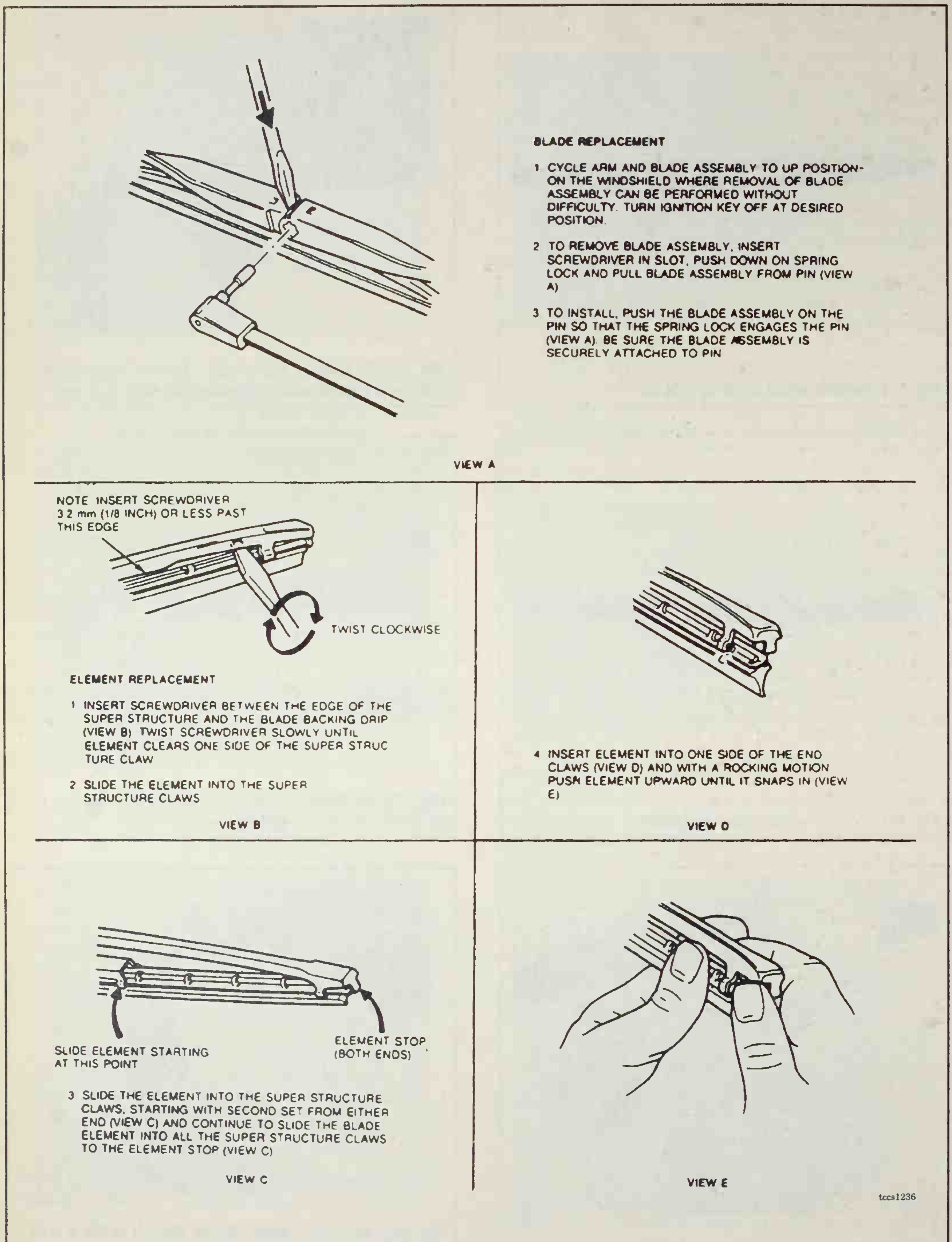

tccs1230

Fig. 175 On Trico® wiper blades, the tab at the end of the blade must be turned up . . .



BLADE REPLACEMENT

1 CYCLE ARM AND BLADE ASSEMBLY TO UP POSITION-ON THE WINDSHIELD WHERE REMOVAL OF BLADE ASSEMBLY CAN BE PERFORMED WITHOUT DIFFICULTY. TURN IGNITION KEY OFF AT DESIRED POSITION.

2 TO REMOVE BLADE ASSEMBLY, INSERT SCREWDRIVER IN SLOT, PUSH DOWN ON SPRING LOCK AND PULL BLADE ASSEMBLY FROM PIN (VIEW A)

3 TO INSTALL, PUSH THE BLADE ASSEMBLY ON THE PIN SO THAT THE SPRING LOCK ENGAGES THE PIN (VIEW A). BE SURE THE BLADE ASSEMBLY IS SECURELY ATTACHED TO PIN

VIEW A
NOTE INSERT SCREWDRIVER 3.2 mm (1/8 INCH) OR LESS PAST THIS EDGE
TWIST CLOCKWISE

ELEMENT REPLACEMENT

1 INSERT SCREWDRIVER BETWEEN THE EDGE OF THE SUPER STRUCTURE AND THE BLADE BACKING DRIP (VIEW B). TWIST SCREWDRIVER SLOWLY UNTIL ELEMENT CLEARS ONE SIDE OF THE SUPER STRUCTURE CLAW

2 SLIDE THE ELEMENT INTO THE SUPER STRUCTURE CLAWS

4 INSERT ELEMENT INTO ONE SIDE OF THE END CLAWS (VIEW D) AND WITH A ROCKING MOTION PUSH ELEMENT UPWARD UNTIL IT SNAPS IN (VIEW E)

VIEW D
SLIDE ELEMENT STARTING AT THIS POINT
ELEMENT STOP (BOTH ENDS)

3 SLIDE THE ELEMENT INTO THE SUPER STRUCTURE CLAWS, STARTING WITH SECOND SET FROM EITHER END (VIEW C) AND CONTINUE TO SLIDE THE BLADE ELEMENT INTO ALL THE SUPER STRUCTURE CLAWS TO THE ELEMENT STOP (VIEW C)

VIEW C
VIEW E
tccs1236

Fig. 176 Trico® wiper blade insert (element) replacement

BLADE REPLACEMENT

1. Cycle arm and blade assembly to a position on the windshield where removal of blade assembly can be performed without difficulty. Turn ignition key off at desired position.
2. To remove blade assembly from wiper arm, pull up on spring lock and pull blade assembly from pin (View A). Be sure spring lock is not pulled excessively or it will become distorted.
3. To install, push the blade assembly onto the pin so that the spring lock engages the pin (View A). Be sure the blade assembly is securely attached to pin.

ELEMENT REPLACEMENT

1. In the plastic backing strip which is part of the rubber blade assembly, there is an 11.11mm (7/16 inch) long notch located approximately one inch from either end. Locate either notch.
2. Place the frame of the wiper blade assembly on a firm surface with either notched end of the backing strip visible.
3. Grasp the frame portion of the wiper blade assembly and push down until the blade assembly is tightly bowed.
4. With the blade assembly in the bowed position, grasp the tip of the backing strip firmly, pulling up and twisting C.C.W. at the same time. The backing strip will then snap out of the retaining tab on the end of the frame.
5. Lift the wiper blade assembly from the surface and slide the backing strip down the frame until the notch lines up with the next retaining tab, twist slightly, and the backing strip will snap out. Continue this operation with the remaining tabs until the blade element is completely detached from the frame.
6. To install blade element, reverse the above procedure, making sure all six (6) tabs are locked to the backing strip before installing blade to wiper arm.

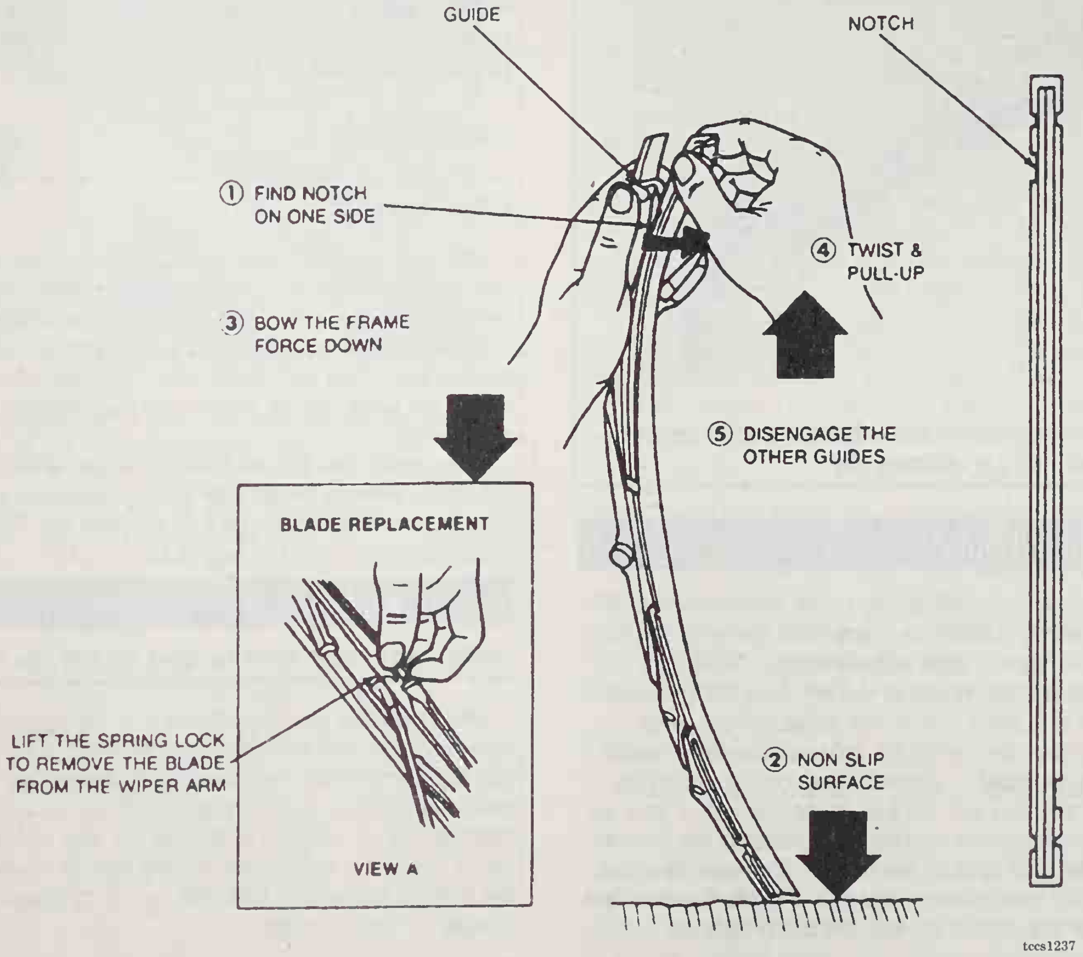

GUIDE
NOTCH
① FIND NOTCH ON ONE SIDE
④ TWIST & PULL-UP
③ BOW THE FRAME FORCE DOWN
⑤ DISENGAGE THE OTHER GUIDES
BLADE REPLACEMENT
LIFT THE SPRING LOCK TO REMOVE THE BLADE FROM THE WIPER ARM
VIEW A
② NON SLIP SURFACE
tccs1237

Fig. 177 Tridon® wiper blade insert (element) replacement

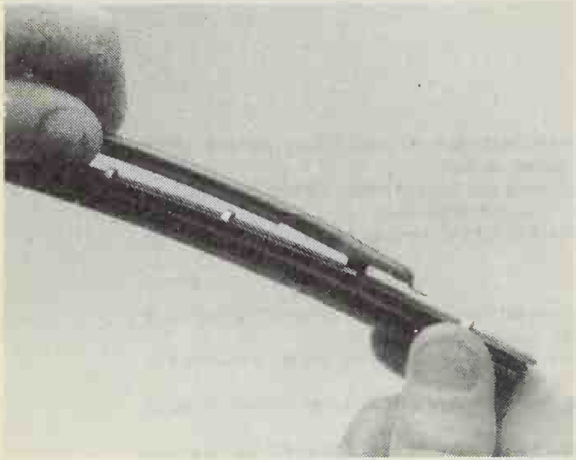


Fig. 178 . . . then the insert can be removed. After installing the replacement insert, bend the tab back

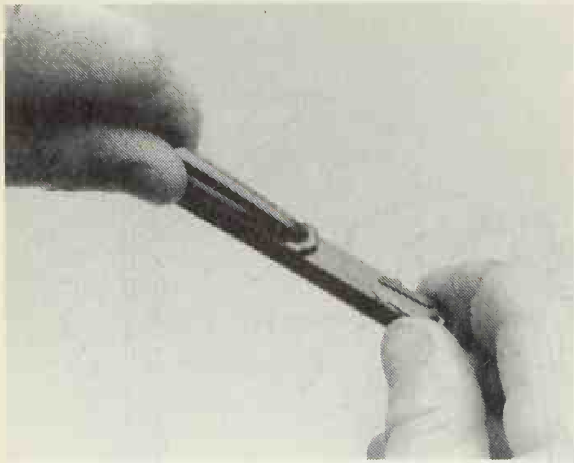


Fig. 179 The Tripledge® wiper blade insert is removed and installed using a securing clip

Tires and Wheels

Common sense and good driving habits will afford maximum tire life. Fast starts, sudden stops and hard cornering are hard on tires and will shorten their useful life span. Make sure that you don't overload the vehicle or run with incorrect pressure in the tires. Both of these practices will increase tread wear.

Inspect your tires frequently. Be especially careful to watch for bubbles in the tread or sidewall, deep cuts or underinflation. Replace any tires with bubbles in the sidewall. If cuts are so deep that they penetrate to the cords, discard the tire. Any cut in the sidewall of a radial tire renders it unsafe. Also look for uneven tread wear patterns that may indicate the front end is out of alignment or that the tires are out of balance.

TIRE ROTATION

➧ See Figures 180 and 181

Tires must be rotated periodically to equalize wear patterns that vary with a tire's position on the vehicle. Tires will also wear in an uneven way as the front steering/suspension system wears to the point where the alignment should be reset.

Rotating the tires will ensure maximum life for the tires as a set, so you will not have to discard a tire early due to wear on only part of the tread. Regular rotation is required to equalize wear.

When rotating "unidirectional tires," make sure that they always roll in the same direction. This means that a tire used on the left side of the vehicle must not be switched to the right side and vice-versa. These tires are marked on the sidewall as to the direction of rotation; observe the mark when reinstalling the tire(s).

Some styled or "mag" wheels may have different offsets front to rear. In these cases, the rear wheels must not be used up front and vice-versa. Furthermore, if these wheels are equipped with unidirectional tires, they cannot be rotated unless the tire is remounted for the proper direction of rotation.

➡The compact or space-saver spare is strictly for emergency use. It must never be included in the tire rotation or placed on the vehicle for everyday use.

TIRE DESIGN

➧ See Figure 182

For maximum satisfaction, tires should be used in sets of four. Mixing of different types (radial, bias-belted, fiberglass belted) must be avoided. In most cases, the vehicle manufacturer has designated a type of tire on which the vehicle will perform best. Your first choice when replacing tires should be to use the same type of tire that the manufacturer recommends.

When radial tires are used, tire sizes and wheel diameters should be selected to maintain ground clearance and tire load capacity equivalent to the original specified tire. Radial tires should always be used in sets of four.

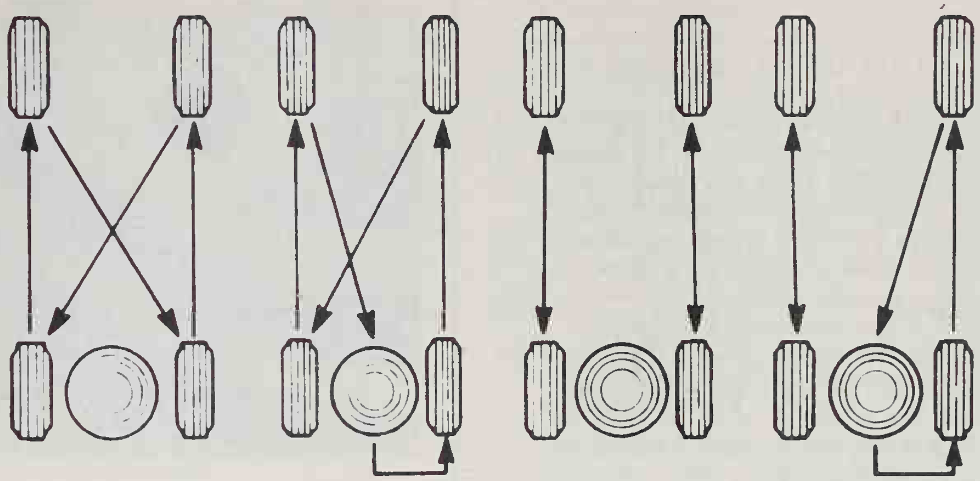
⁂CAUTION

Radial tires should never be used on only the front axle.

When selecting tires, pay attention to the original size as marked on the tire. Most tires are described using an industry size code sometimes referred to as P-Metric. This allows the exact identification of the tire specifications, regardless of the manufacturer. If selecting a different tire size or brand, remember to check the installed tire for any sign of interference with the body or suspension while the vehicle is stopping, turning sharply or heavily loaded.

Snow Tires

Good radial tires can produce a big advantage in slippery weather, but in snow, a street radial tire does not have sufficient tread to provide traction and control. The small grooves of a street tire quickly pack with snow and the tire behaves

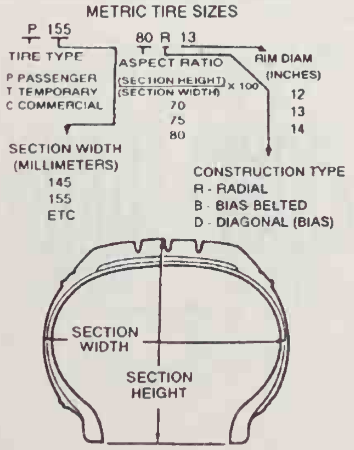


tccs1259

Fig. 180 Common tire rotation patterns for 4 and 5 wheel rotations

tccs1234

Fig. 181 Unidirectional tires can only be rotated on the same side of the vehicle (front-to-rear)


METRIC TIRE SIZES
P 155
80 R 13
TIRE TYPE
P PASSENGER
T TEMPORARY
C COMMERCIAL
ASPECT RATIO
(SECTION HEIGHT) / (SECTION WIDTH) X 100
70
75
80
RIM DIAM (INCHES)
12
13
14
SECTION WIDTH (MILLIMETERS)
145
155
ETC
CONSTRUCTION TYPE
R - RADIAL
B - BIAS BELTED
D - DIAGONAL (BIAS)
SECTION WIDTH
SECTION HEIGHT

tccs1261

Fig. 182 P-Metric tire coding

like a billiard ball on a marble floor. The more open, chunky tread of a snow tire will self-clean as the tire turns, providing much better grip on snowy surfaces.

To satisfy municipalities requiring snow tires during weather emergencies, most snow tires carry either an M + S designation after the tire size stamped on the sidewall, or the designation "all-season." In general, no change in tire size is necessary when buying snow tires.

Most manufacturers strongly recommend the use of 4 snow tires on their vehicles for reasons of stability. If snow tires are fitted only to the drive wheels, the opposite end of the vehicle may become very unstable when braking or turning on slippery surfaces. This instability can lead to unpleasant endings if the driver can't counteract the slide in time.

Note that snow tires, whether 2 or 4, will affect vehicle handling in all non-snow situations. The stiffer, heavier snow tires will noticeably change the turning and braking characteristics of the vehicle. Once the snow tires are installed, you must re-learn the behavior of the vehicle and drive accordingly.

➡Consider buying extra wheels on which to mount the snow tires. Once done, the "snow wheels" can be installed and removed as needed. This eliminates the potential damage to tires or wheels from seasonal removal and installation. Even if your vehicle has styled wheels, see if inexpensive steel wheels are available. Although the look of the vehicle will change, the expensive wheels will be protected from salt, curb hits and pothole damage.

TIRE STORAGE

If they are mounted on wheels, store the tires at proper inflation pressure. All tires should be kept in a cool, dry place. If they are stored in the garage or basement, do not let them stand on a concrete floor; set them on strips of wood, a mat or a large stack of newspaper. Keeping them away from direct moisture is of paramount importance. Tires should not be stored upright, but in a flat position.

INSPECTION

See Figures 183, 184, 185, 186, 187, 188, 189 and 190

The importance of proper tire inflation cannot be overemphasized. A tire employs air as part of its structure. It is designed around the supporting strength of the air at a specified pressure. For this reason, improper inflation drastically reduces the tires's ability to perform as intended. A tire will lose some air in day-to-day use; having to add a few pounds of air periodically is not necessarily a sign of a leaking tire.

Two items should be a permanent fixture in every glove compartment: an accurate tire pressure gauge and a tread depth gauge. Check the tire pressure (including the spare) regularly with a pocket type gauge. Too often, the gauge on the end of the air hose at your corner garage is not accurate because it suffers too much abuse. Always check tire pressure when the tires are cold, as pressure increases with temperature. If you must move the vehicle to check the tire inflation, do not drive more than a mile before checking. A cold tire is generally one that has not been driven for more than three hours.

A plate or sticker is normally provided somewhere in the vehicle (door post, hood, tailgate or trunk lid) which shows the proper pressure for the tires. Never counteract excessive pressure build-up by bleeding off air pressure (letting some air out). This will cause the tire to run hotter and wear quicker.

⁂CAUTION

Never exceed the maximum tire pressure embossed on the tire! This is the pressure to be used when the tire is at maximum loading, but it is rarely the correct pressure for everyday driving. Consult the owner's manual or the tire pressure sticker for the correct tire pressure.

Once you've maintained the correct tire pressures for several weeks, you'll be familiar with the vehicle's braking and handling personality. Slight adjustments in tire pressures can fine-tune these characteristics, but never change the cold pressure specification by more than 2 psi. A slightly softer tire pressure

tccs1097

Fig. 183 Tires should be checked frequently for any sign of puncture or damage

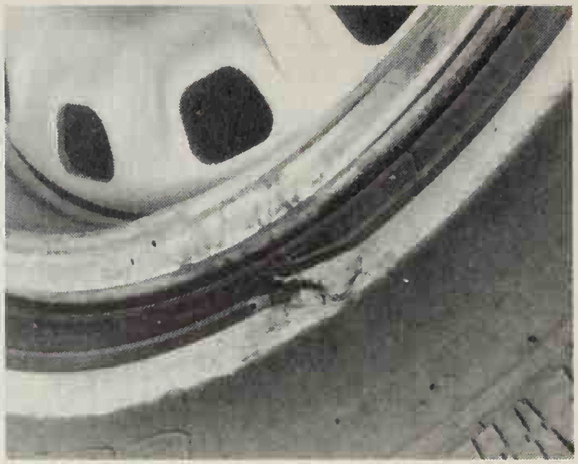
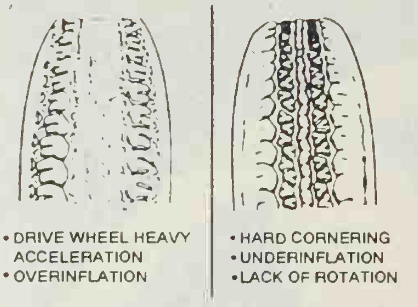
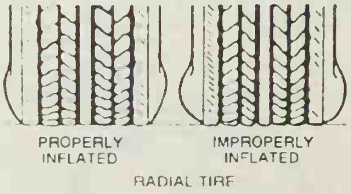

tccs1095

Fig. 184 Tires with deep cuts, or cuts which show bulging should be replaced immediately



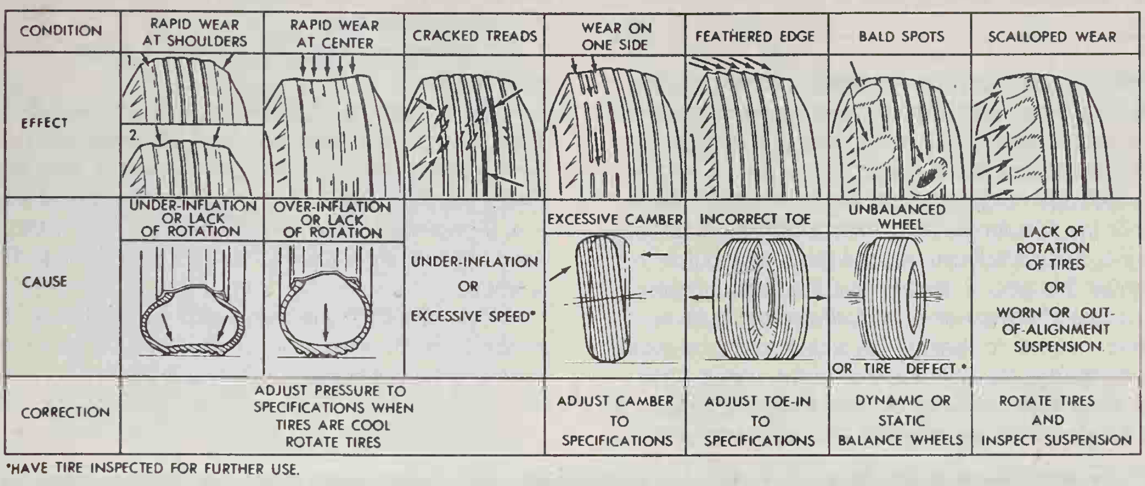
tccs1262

Fig. 185 Examples of inflation-related tire wear patterns



tccs1263

Fig. 186 Radial tires have a characteristic sidewall bulge; don't try to measure pressure by looking at the tire. Use a quality air pressure gauge



CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT	1. 2.						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT*	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION

*HAVE TIRE INSPECTED FOR FURTHER USE.

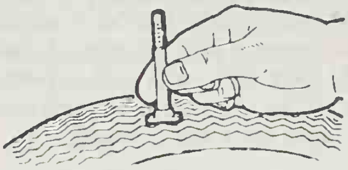
tccs1267

Fig. 187 Common tire wear patterns and causes

will give a softer ride but also yield lower fuel mileage. A slightly harder tire will give crisper dry road handling but can cause skidding on wet surfaces. Unless you're fully attuned to the vehicle, stick to the recommended inflation pressures.

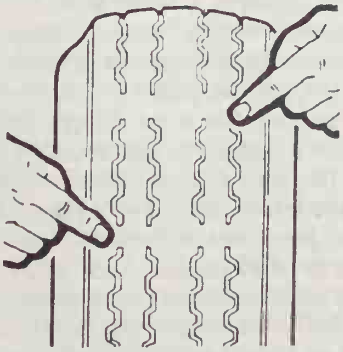
All tires made since 1968 have built-in tread wear indicator bars that show up as ½ in. (13mm) wide smooth bands across the tire when ¹⁄₁₆ in. (1.5mm) of tread remains. The appearance of tread wear indicators means that the tires should be replaced. In fact, many states have laws prohibiting the use of tires with less than this amount of tread.

You can check your own tread depth with an inexpensive gauge or by using a Lincoln head penny. Slip the Lincoln penny (with Lincoln's head upside-down) into several tread grooves. If you can see the top of Lincoln's head in 2 adjacent grooves, the tire has less than ¹⁄₁₆ in. (1.5mm) tread left and should be replaced. You can measure snow tires in the same manner by using the "tails" side of the Lincoln penny. If you can see the top of the Lincoln memorial, it's time to replace the snow tire(s).



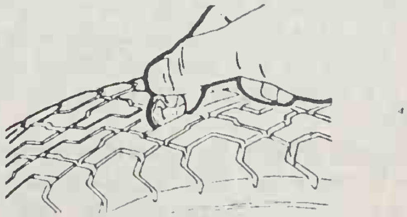
tccs1264

Fig. 189 Accurate tread depth indicators are inexpensive and handy



tccs1265

Fig. 188 Tread wear indicators will appear when the tire is worn



tccs1266

Fig. 190 A penny works well for a quick check of tread depth

CARE OF SPECIAL WHEELS

If you have invested money in magnesium, aluminum alloy or sport wheels, special precautions should be taken to make sure your investment is not wasted and that your special wheels look good for the life of the vehicle.

Special wheels are easily damaged and/or scratched. Occasionally check the rims for cracking, impact damage or air leaks. If any of these are found, replace the wheel. But in order to prevent this type of damage and the costly replacement of a special wheel, observe the following precautions:

- Use extra care not to damage the wheels during removal, installation, balancing, etc. After removal of the wheels from the vehicle, place them on a mat or other protective surface. If they are to be stored for any length of time, support them on strips of wood. Never store tires and wheels upright; the tread may develop flat spots.
- When driving, watch for hazards; it doesn't take much to crack a wheel.
- When washing, use a mild soap or non-abrasive dish detergent (keeping in mind that detergent tends to remove wax). Avoid cleansers with abrasives or the use of hard brushes. There are many cleaners and polishes for special wheels.
- If possible, remove the wheels during the winter. Salt and sand used for snow removal can severely damage the finish of a wheel.
- Make certain the recommended lug nut torque is never exceeded or the wheel may crack. Never use snow chains on special wheels; severe scratching will occur.

FLUIDS AND LUBRICANTS

Fluid Disposal

Used fluids such as engine oil, transmission fluid, antifreeze and brake fluid are hazardous wastes and must be disposed of properly. Before draining any fluids, consult with your local authorities; in many areas, waste oil, etc. is being accepted as a part of recycling programs. A number of service stations and auto parts stores are also accepting waste fluids for recycling.

Be sure of the recycling center's policies before draining any fluids, as many will not accept different fluids that have been mixed together, such as oil and antifreeze.

Fuel and Engine Oil Recommendations

GENERAL INFORMATION

Oils

➧ See Figures 191, 192 and 193

The SAE (Society of Automotive Engineers) grade number indicates the viscosity of the engine oil; its resistance to flow at a given temperature. The lower the SAE grade number, the lighter the oil. For example, the mono-grade oils begin with SAE 5 weight, which is a thin, light oil, and continue in viscosity up to SAE 80 or 90 weight, which are heavy gear lubricants. These oils are also known as "straight weight", meaning they are of a single viscosity, and do not vary with engine temperature.

Multi-viscosity oils offer the important advantage of being adaptable to temperature extremes. These oils have designations such as 10W-40, 20W-50, etc. The "10W-40" means that in winter (the "W" in the designation) the oil acts like a thin 10 weight oil, allowing the engine to spin easily when cold and offering rapid lubrication. Once the engine has warmed up, however, the oil acts like a straight 40 weight, maintaining good lubrication and protection for the engine's internal components. A 20W-50 oil would therefore be slightly heavier than and not as ideal in cold weather as the 10W-40, but would offer better protection at higher rpm and temperatures because when warm it acts like a 50 weight oil. Whichever oil viscosity you choose when changing the oil, make sure you are anticipating the temperatures your engine will be operating in until the oil is changed again. Refer to the oil viscosity chart for oil recommendations according to temperature.

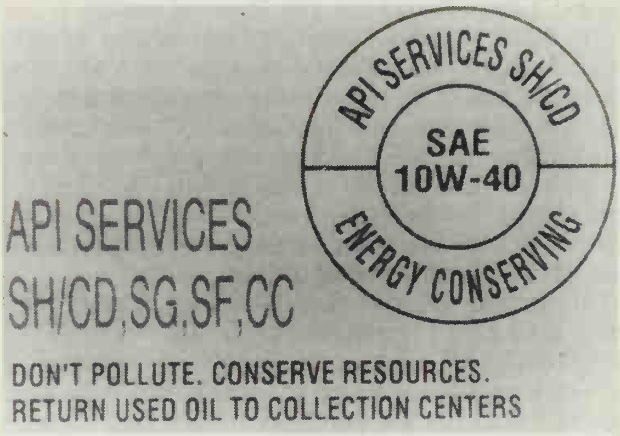


Fig. 191 Look for the API oil identification label when choosing your engine oil

The API (American Petroleum Institute) designation indicates the classification of engine oil used under certain given operating conditions. Only oils designated for use "Service SG" or greater should be used. Oils of the SG type perform a variety of functions inside the engine in addition to the basic function as a lubricant. Through a balanced system of metallic detergents and polymeric dispersants, the oil prevents the formation of high and low temperature deposits and also keeps sludge and particles of dirt in suspension. Acids, particularly sulfuric acid, as well as other by-products of combustion, are neutralized. Both the SAE grade number and the API designation bottle be found on the oil can. For recommended oil viscosities, refer to the chart.

SYNTHETIC OIL

There are many excellent synthetic oils currently available that can provide better gas mileage, longer service life, and in some cases better engine protection. These benefits do not

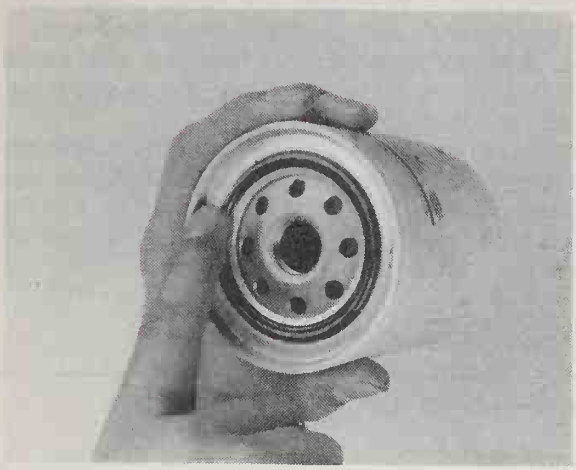
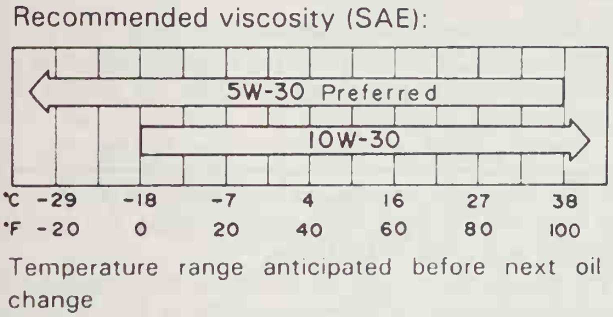

TCCS1901

Fig. 192 Before installing a new oil filter, coat the rubber gasket with clean oil



86821236

Fig. 193 Viscosity chart

come without a few hitches, however; the main one being the price of synthetic oils, which is three or four times the price per quart of conventional oil.

Synthetic oil is not for every truck and every type of driving, so you should consider your engine's condition and your type of driving. Also, check your truck's warranty conditions regarding the use of synthetic oils.

Both brand new engines and older, high mileage engines are often the wrong candidates for synthetic oil. A synthetic oil can be so slippery that they can prevent the proper break-in of new engines; most manufacturers recommend that you wait until the engine is properly broken in 3000 miles (4830 km) before using synthetic oil. Older engines with wear have a different problem with synthetics: they leak more oil as they age. Slippery synthetic oils get past worn parts easily. If your truck is leaking oil past old seals you'll most probably have a much greater leak problem with synthetics.

Consider your type of driving. If most of your accumulated mileage is high speed, highway type driving, the more expensive synthetic oils may be a benefit. Extended highway driving gives the engine a chance to warm up, accumulating less acids in the oil and putting less stress on the engine over the long run. Trucks with synthetic oils may show increased fuel economy in highway driving, due to less internal friction.

If synthetic oil is used, it should still be replaced at regular intervals as stated in the maintenance schedule. While the oil itself will last much longer than regular oil, pollutants such as soot, water and unburned fuel still accumulate within the oil. These are the damaging elements within a motor and must be drained regularly to prevent damage.

Trucks used under harder circumstances, such as stop-and-go, city type driving, short trips, or extended idling, should be serviced more frequently. For the engines in these trucks, the much greater cost of synthetic or fuel-efficient oils may not be worth the investment. Internal wear increases much quicker on these trucks, causing greater oil consumption and leakage.

Fuel

It is important to use fuel of the proper octane rating in your truck. Octane rating is based on the quantity of anti-knock compounds added to the fuel and it determines the speed at which the gas will burn. The lower the octane rating, the faster it burns. The higher the octane, the slower the fuel will burn and a greater percentage of compounds in the fuel prevent spark ping (knock), detonation and pre-ignition (dieseling).

As the temperature of the engine increases, the air/fuel mixture exhibits a tendency to ignite before the spark plug is fired. If fuel of an octane rating too low for the engine is used, this will allow combustion to occur before the piston has completed its compression stroke, thereby creating a very high pressure very rapidly.

Fuel of the proper octane rating, for the compression ratio and ignition timing of your truck, will slow the combustion process sufficiently to allow the spark plug enough time to ignite the mixture completely and smoothly. The use of some super-premium fuel is no substitution for a properly tuned and maintained engine. Chances are that if your engine exhibits any signs of spark ping, detonation or pre-ignition when using regular fuel, the ignition timing should be checked against specifications or the cylinder head should be removed for decarbonizing.

Vehicles equipped with catalytic converters must use UNLEADED GASOLINE only. Use of leaded fuel shortens the life of spark plugs, exhaust systems and EGR valves and can damage the catalytic converter. Most converter equipped models are designed to operate using unleaded gasoline with a minimum rating of 91 octane. Use of unleaded gas with octane ratings lower than 91 can cause persistent spark knock which could lead to engine damage.

Light spark knock may be noticed when accelerating or driving up hills, particularly with a carbureted engine. The slight knocking may be considered normal (with 91 octane) because the maximum fuel economy is obtained under condition of occasional light spark knock. Gasoline with an octane rating higher than 91 may be used, but it is not necessary (in most cases) for proper operation.

➠Your engine's fuel requirement can change with time, mainly due to carbon buildup, which changes the compression ratio. If your engine pings, knocks or runs on, switch to a higher grade of fuel. Sometimes just changing brands will cure the problem. If it becomes necessary to retard the timing from specifications, don't change it more than a few degrees. Retarded timing will reduce power output and fuel mileage and will increase the engine temperature.

Engine

OIL LEVEL CHECK

➧ See Figure 194

⁂CAUTION

Prolonged and repeated skin contact with used engine oil, with no effort to remove the oil, may cause skin cancer. Always follow these simple precautions when handling used motor oil:

- Avoid prolonged skin contact with used motor oil.
- Remove oil from skin by washing thoroughly with soap and water or waterless hand cleaner. Do not use gasoline, thinners or other solvents.
- Avoid prolonged skin contact with oil-soaked clothing.

Every time you stop for fuel, check the engine oil as follows:

1. Park the truck on level ground.
2. When checking the oil level it is best for the engine to be at operating temperature, although checking the oil immediately after a stopping will lead to a false reading. Wait a few minutes after turning off the engine to allow the oil to drain back into the oil pan (crankcase).
3. Open the hood and locate the dipstick. Pull the dipstick from its tube, wipe it clean and reinsert it.

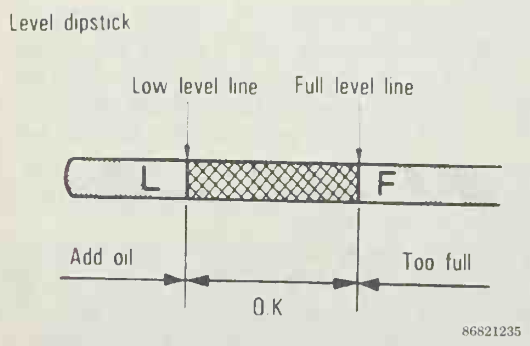


Fig. 194 Read the dipstick carefully, add oil when the level is below the L mark; do not overfill

4. Pull the dipstick out again and, holding it horizontally, read the oil level. The oil should be between the **F** and **L** marks on the dipstick. If the oil is below the **L** mark, add oil of the proper viscosity through the capped opening on the top of the cylinder head cover.
5. Reinsert the dipstick and check the oil level again after adding any oil. Be careful not to overfill the crankcase. Approximately one quart of oil will raise the level from the **L** to the **F**. Excess oil will generally be consumed at an accelerated rate as well as hampering engine operation.

OIL AND FILTER CHANGE

➧ See Figures 195, 196, 197, 198, 199 and 200

The oil and filter should be changed every 7500 miles (12,000 km).

⁂CAUTION

Prolonged and repeated skin contact with used engine oil, with no effort to remove the oil, may cause skin cancer. Always follow these simple precautions when handling used motor oil:

- Avoid prolonged skin contact with used motor oil.
- Remove oil from skin by washing thoroughly with soap and water or waterless hand cleaner. Do not use gasoline, thinners or other solvents.
- Avoid prolonged skin contact with oil-soaked clothing.

The oil drain plug is located on the bottom, rear of the oil pan (bottom of the engine, underneath the truck). The oil filter is located on the side of the engine.

The mileage figures given are the Toyota recommended intervals assuming normal driving and conditions. Normal driving requires that the vehicle be driven far enough to warm up the oil; usually this is about 10 miles (16 km) or so. If your everyday use is shorter than this (one way), your use qualifies as severe duty.

Severe duty includes dusty, polluted or off-road conditions, as well as stop-and-go short haul uses. Regularly towing a trailer also puts the truck in this category, as does constant operation with a near capacity load. Change the oil and filter at ½ the normal interval. Half of 7500 equals 3250 miles (5229 km); round it down to the easily remembered 3000 mile (5000 km) interval. For some owners, that may be once a month; for others, it may be six months.

Always drain the oil after the engine has been running long enough to bring it to normal operating temperature. Hot oil will flow easier and more contaminants will be removed along with the oil than if it were drained cold. To change the oil and filter:

1. Run the engine until it reaches normal operating temperature.
2. Jack up the front of the truck and support it on safety stands.
3. Slide a drain pan of at least 6 quarts capacity under the oil pan.
4. Loosen the drain plug with a wrench. Turn the plug out by hand. By keeping an inward pressure on the plug as you unscrew it, oil won't escape past the threads and you can remove it without being burned by hot oil.

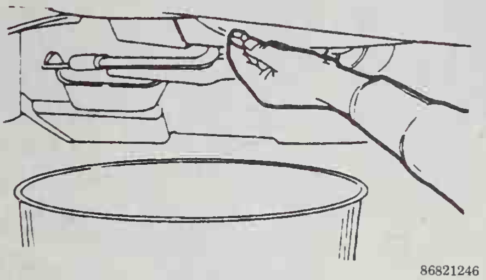


Fig. 195 Keeping an upward pressure on the drain plug while unscrewing it will prevent oil leakage until you're ready for it

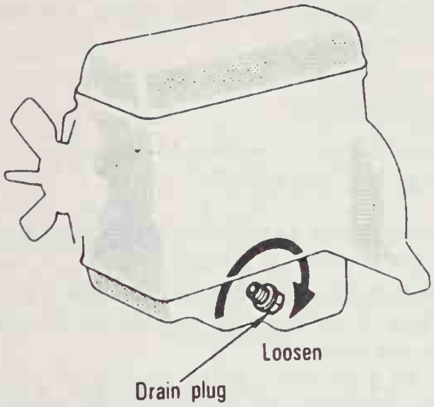

Loosen
Drain plug
86821239

Fig. 196 Oil drain plug location — 1FZ-FE

Drain plug (3RZ-FE engine)

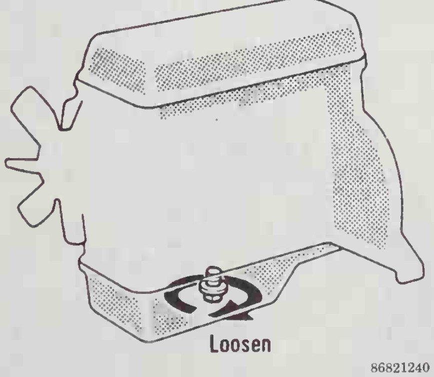

Loosen
86821240

Fig. 197 Oil drain plug location — 3RZ-FE

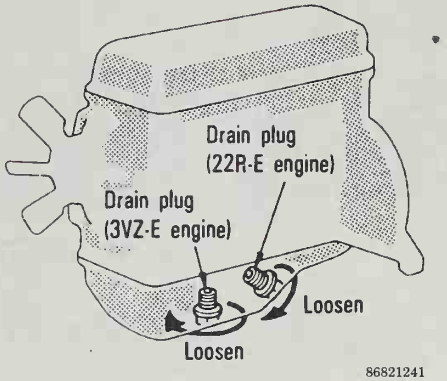

Drain plug
(22R-E engine)
Drain plug
(3VZ-E engine)
Loosen
Loosen
86821241

Fig. 198 Oil drain plug location — 22R-E and 3VZ-E

5. Allow the oil to drain completely and then install the drain plug. Don't overtighten the plug, or you'll be buying a new pan or a replacement plug for stripped threads.

6. Using a filter wrench, remove the oil filter. Keep in mind that it's holding about one quart of dirty, hot oil. Make certain the old gasket comes off with the filter and is not stuck to the block.

7. Empty the old filter into the drain pan and dispose of the filter.

8. Using a clean rag, wipe off the filter adapter on the engine block. Be sure that the rag doesn't leave any lint which could clog an oil passage.

9. Coat the rubber gasket on the filter with fresh oil. Spin it onto the engine by hand; when the gasket touches the adapter surface give it another ½-¾ turn. No more, or you'll squash the gasket and it will leak.

10. Refill the engine with the correct amount of fresh oil. See the "Capacities" chart.

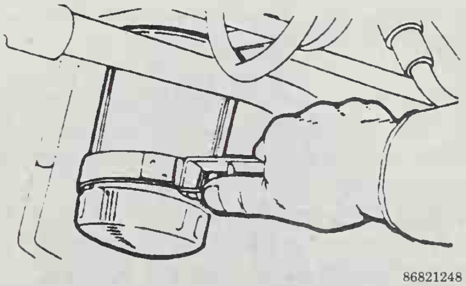


Fig. 199 An oil filter wrench is very handy. Try not to bang any components; damaging one can be costly

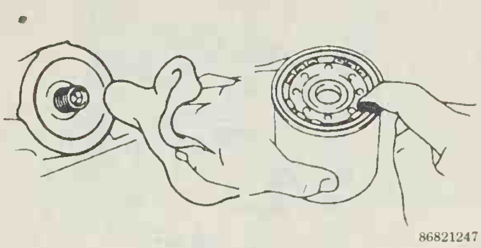


Fig. 200 With a lint free rag, clean the surface of the filter contact. Apply oil to the filter O-ring prior to installation

11. Check the oil level on the dipstick. It is normal for the level to be a bit above the full mark. Start the engine and allow it to idle for a few minutes.

✲✲WARNING

Do not run the engine above idle speed until it has built up oil pressure, indicated when the oil light goes out.

12. Shut **OFF** the engine, allow the oil to drain for a minute, and check the oil level. Check around the filter and drain plug for any leaks, and correct as necessary.

Manual Transmission

FLUID RECOMMENDATIONS

All vehicles use a multipurpose gear oil. The recommended types are: API GL-3, GL-4 or GL-5 with the viscosity SAE 75W-90 or 80W-90.

LEVEL CHECK

➧ See Figures 201, 202, 203 and 204

The oil in the manual transmission should be checked at least every 7500 miles (12,000 km) and replaced every 25,000-30,000 miles (40,000-48,000 km). Even more frequently if driven in deep water.

1. With the truck parked on a level surface, remove the filler plug (17mm) from the side of the transmission housing. A gasket will also have to be removed and discarded.
2. If the lubricant begins to trickle out of the hole, there is enough. Otherwise, carefully insert your finger (watch out for sharp threads) and check to see if the oil is up to the edge of the hole.
3. If not, add oil through the hole until the level is at the edge of the hole. Most gear lubricants come in a plastic squeeze bottle with a nozzle; making additions simple. You can also use a common everyday kitchen faster.
4. Install the filler plug with a new gasket. Run the engine and check for leaks.

Fig. 201 Use a wrench to remove the 17mm plug on the side of the case

DRAIN AND REFILL

➧ See Figures 205, 206 and 207

The oil in the manual transmission should be changed at least every 30,000 miles (48,000 km).

1. The transmission oil should be hot before it is drained. If the engine is at normal operating temperature, the transmission oil should be hot enough.
2. Raise the truck and support it properly on jackstands so that you can safely work underneath. You will probably not have enough room to work if the truck is not raised.
3. The drain plug is located on the bottom of the transmission. It is usually on the passenger side on four speeds, and on the bottom center of five speeds. Place a pan under the drain plug, then remove it. Keep a slight upward pressure on

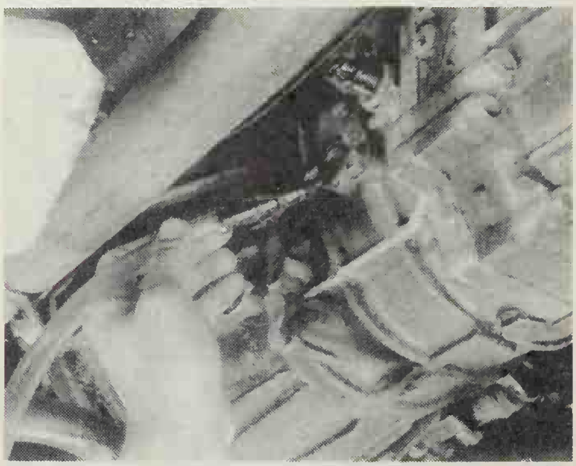


Fig. 202 A gear pump with a nozzle is also a type used to fill the case

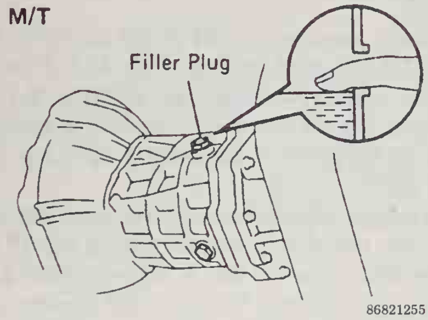


Fig. 203 The fill plug and drain plug locations on the 22R-E and the 3VZ-E engines

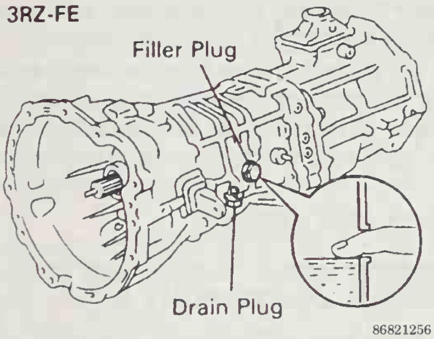


Fig. 204 The fill plug and drain plug locations on the 3RZ-FE engine

the plug while unscrewing it, this will keep the oil from pouring out until the plug is removed.

✲✲CAUTION

The oil will be HOT. Be careful when you remove the plug so that you don't take a bath in hot gear oil.

4. Allow the oil to drain completely.
5. Clean off the plug then install it, tightening it until just snug.
6. Remove the filler plug from the side of the transmission case. It is usually on the driver's side of four speeds, and on the passenger side on five speeds. There will be a gasket underneath this plug. Replace it every time the bolt is removed.
7. Fill the transmission with gear oil through the filler plug hole.
8. The oil level should come right up to the edge of the hole. You can stick your finger in to verify this. Watch out for sharp threads.

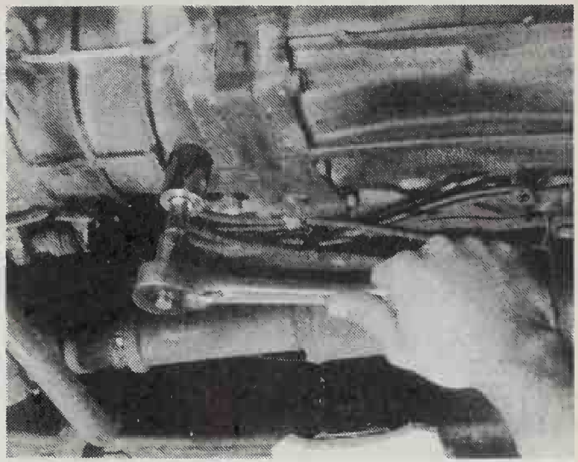


Fig. 205 Use a short extension to aid in removing the drain plug

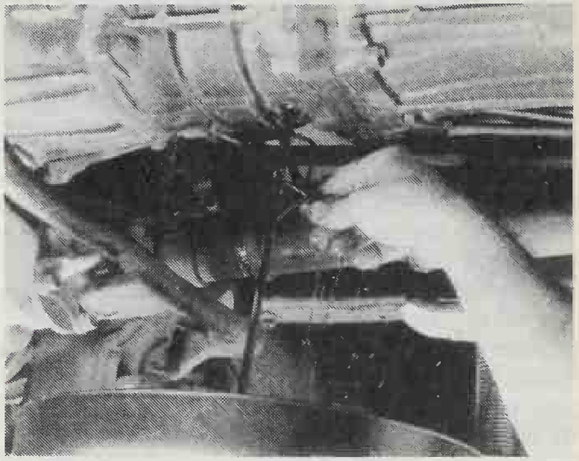


Fig. 206 Quickly remove the plug to avoid getting oil on your hands

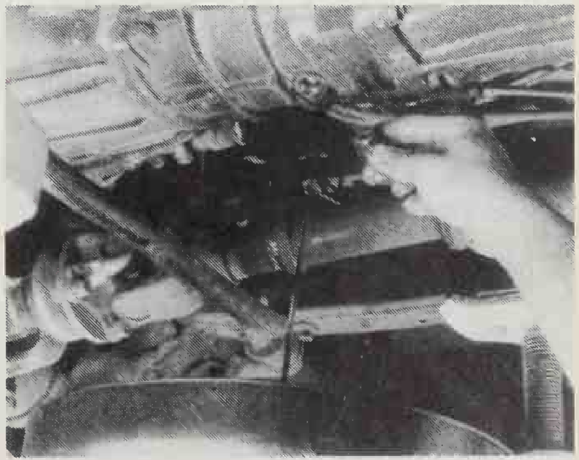


Fig. 207 Allow the fluid to drain completely into a pan or container, before reinstalling the plug

9. Install the filler plug and gasket, lower the truck, then check for leaks. Dispose of the old oil in the proper manner.

Automatic Transmission

FLUID RECOMMENDATIONS

All automatic transmissions covered in this manual use DEXRON® II or its superceding fluid type.

LEVEL CHECK

◗ **See Figure 208**

Check the automatic transmission fluid level at least every 15,000 miles (24,000 km) or more if possible. The dipstick is usually located in the rear of the engine compartment. The fluid level should be checked only when the transmission is hot (normal operating temperature). The transmission is considered hot after about 20 miles (32 km) of highway driving.

1. Park the truck on a level surface with the engine idling. Shift the transmission into Neutral or Park and set the parking brake.
2. Remove the dipstick, wipe it clean and reinsert if firmly. Be sure that it has been pushed all the way in. Remove the dipstick and check the fluid level while holding it horizontally. With the engine running, the fluid level should be between the second and third notches on the dipstick.
3. If the fluid level is below the second notch, add fluid with the aid of a funnel.
4. Check the level often as you are filling the transmission. Be extremely careful not to overfill it. Overfilling will cause slippage, seal damage and overheating. Approximately one pint of ATF will raise the level from one notch to the other.

The fluid on the dipstick should always be a bright red color. It if is discolored (brown or black), or smells burnt, serious transmission troubles, probably due to overheating, should be suspected. The transmission should be inspected by a qualified service technician to locate the cause of the burnt fluid.

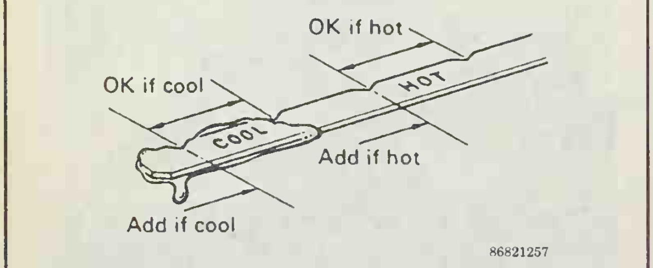


Fig. 208 When checking the dipstick on the automatic transmission, read the stick carefully

DRAIN AND REFILL

◗ **See Figure 209**

The automatic transmission fluid should be changed at least every 25,000-30,000 miles (40,000-48,000 km). If the truck is normally used in severe service, such as stop-and-go driving, trailer towing or the like, the interval should be halved. The fluid should be hot before it is drained; a 20 minute drive will accomplish this.

Toyota automatic transmissions are equipped with a drain plug in the pan, so that fluid may be drained without removing the pan. The filter within the pan is not replaceable as a maintenance item; removing the pan is not required or recommended during normal transmission maintenance.

1. With the truck safely supported on stands, position a large catch pan below the drain plug.
2. Remove the plug and gasket slowly, and be prepared for a rush of **HOT** fluid. Allow the unit to drain for some minutes; when the flow of oil is down to individual drops.
3. Install the drain plug with a new gasket if used, and tighten just snug. Add transmission fluid through the dipstick tube under the hood.
4. Reinsert the dipstick after filling, then start the engine and allow it to idle. DO NOT race the engine.
5. After the engine has idled for a few minutes, shift the transmission slowly through the gears, then return it to Park. With the engine still idling, check the fluid level on the dipstick. If necessary, add more fluid to raise the level.

PAN AND FILTER SERVICE

◗ **See Figures 210, 211, 212 and 213**

1. Jack up the front end of the vehicle and support it on jackstands.
2. Place a container under the transmission drain plug and drain the transmission fluid.
3. Remove the pan securing bolts and remove the pan and gasket. On all but the A43/A44 family, this will require the use of a thin, flat bladed tool to cut the sealant bead. Do NOT use

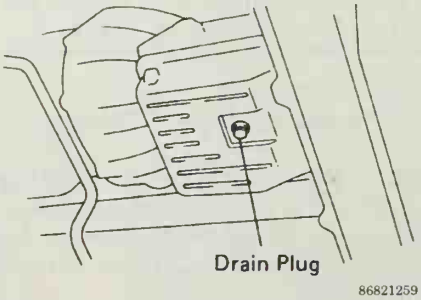


Fig. 209 All automatics have a drain plug to ease the removal of fluid

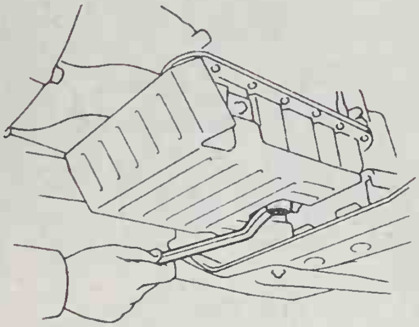


Fig. 210 Remove the drain plug with an appropriate wrench

a screwdriver (you'll deform the pan lip) and do NOT drive the tool straight into the seam; if it goes too far, internal damage will result. Work on an angle to the pan and tap the tool just deeply enough to cut the sealer.

4. The pan may be washed in solvent for cleaning but must be absolutely dry when it is reinstalled. Do not wipe it out with a rag; the lint from the rag can damage the transmission. Additionally, the pans for the A43D, A44D and A440F units contain magnets; clean any shavings from the magnets and make certain the magnet(s) are correctly positioned before reinstallation.

5. Remove all traces of the old gasket or sealer from the pan and from the transmission. On A43/A44 series, install a new gasket on the pan but do not use any sealer. On all other units, apply a thin, even bead of sealant around the pan, staying inboard of the screw holes and roughly centered on the pan flange.

6. Inspect, clean or replace the transmission filter or strainer at this time, if necessary. If the filter is removed, be ready for an additional rush of fluid. For all transmissions except the A440F, tighten the bolts to 48 inch lbs. (6 Nm). On the A440F, tighten the 8mm bolts to 48 inch lbs. (6 Nm) and the 10mm bolts to 7 ft. lbs. (10 Nm).

7. Install the pan, tightening the securing bolts to the proper torque in a crisscrossing pattern. Correct pan bolt tightness:

- A43D and A44D — 48 inch lbs. (6 Nm)
- A340E, F and H — 65 inch lbs. (7 Nm)
- A440F — 61 inch lbs. (7 Nm)

⁂WARNING

The pan bolts must be tightened evenly; the bolts break easily if overtightened.

8. Fill the transmission to the correct level with the specified fluid.

Transfer Case

FLUID RECOMMENDATIONS

- Trucks and 4Runner's w/MT — multipurpose gear oil API GL-3, GL-4 or GL-5; SAE 75W-90 or 80W-90
- Trucks and 4Runner's w/AT — ATF DEXRON®II or its superceding fluid type
- Land Cruiser — multipurpose gear oil API GL-4 or GL-5; SAE 90W.

LEVEL CHECK

➧ See Figures 214, 215 and 216

The oil in the transfer case should be checked at least every 7500 miles (12,000 km) and replaced every 25,000-30,000 miles (40,000-48,000 km), even more frequently if driven in deep water.

1. With the truck parked on a level surface, remove the filler plug from the side of the transfer housing.

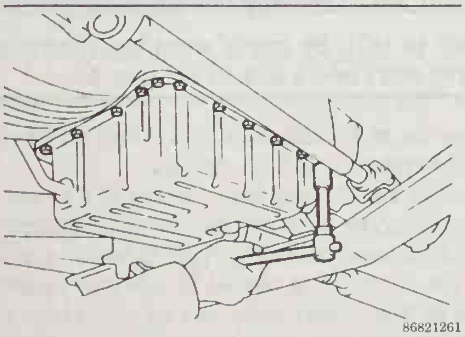


Fig. 211 Most of the pan bolts should be accessible, you may need to remove another part to obtain access for some

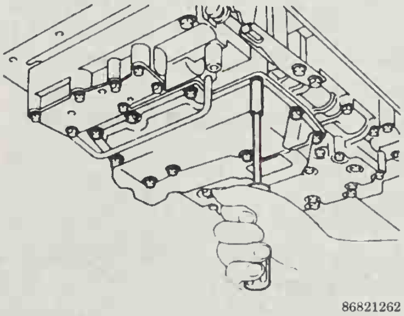


Fig. 212 Bolts secure the strainer, do not mix them up with the pan bolts

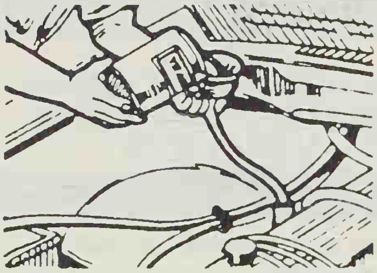

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Fig. 213 A funnel with a long, flexible neck allows you to add fluid to the automatic transmission

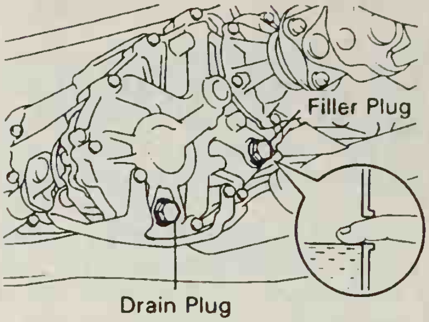

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Fig. 215 Watch the threads in the filler plug, they can be sharp

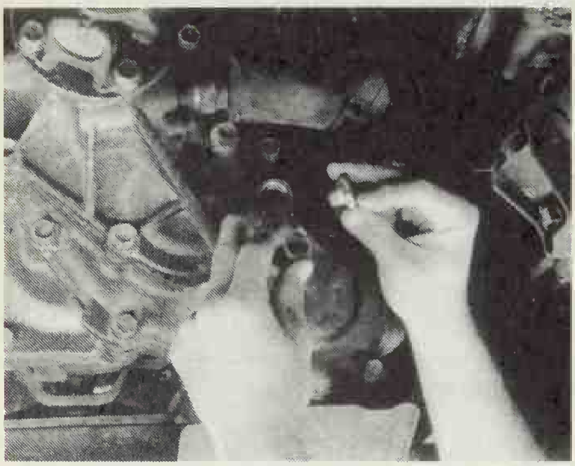
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Fig. 214 When removing the filler plug, remember there is a gasket, usually metal

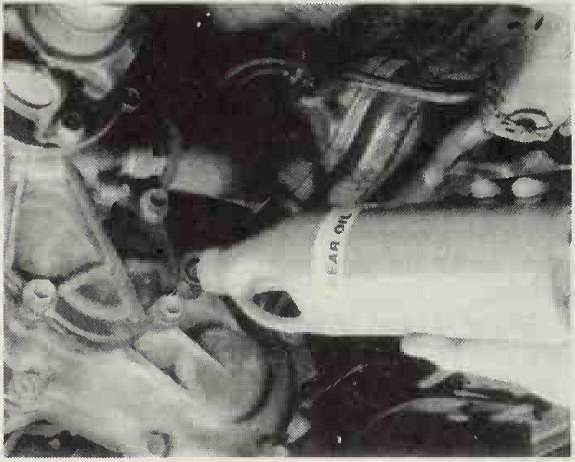
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Fig. 216 The gear oil is usually in a long container with a built-in spout

2. If the lubricant begins to trickle out of the hole, there is enough. Otherwise, carefully insert your finger (watch out for sharp threads) and check to see if the oil is up to the edge of the hole.

3. If not, add oil through the hole until the level is at the edge of the hole. Most gear lubricants come in a plastic squeeze bottle with a nozzle; making additions simple. You can also use a common everyday kitchen faster.

4. Install the filler plug and gasket, then run the engine and check for leaks.

DRAIN AND REFILL

See Figures 217 and 218

1. The transfer case oil should be hot before it is drained. If the engine is at normal operating temperature, the oil should be hot enough.

2. Raise the truck and support it properly on jackstands so that you can safely work underneath.

3. The drain plug is usually located on the bottom of the transfer case. Place a pan under the drain plug and remove it.

CAUTION

The oil will be HOT. Be careful when you remove the plug so that you don't take a bath in hot gear oil.

4. Allow the oil to drain completely. Clean off the plug and install it, tightening it until it is just snug.

5. Remove the filler plug from the side of the case.

6. Fill the transfer case with the correct oil through the filler plug hole as detailed previously. Refer to the "Capacities" chart for the amount of oil needed to refill your transfer case.

7. The oil level should come right up to the edge of the hole. You can stick your finger in to verify this.

8. Install the filler plug with a new gasket, lower the truck, and check for leaks. Dispose of the old oil in the proper manner.

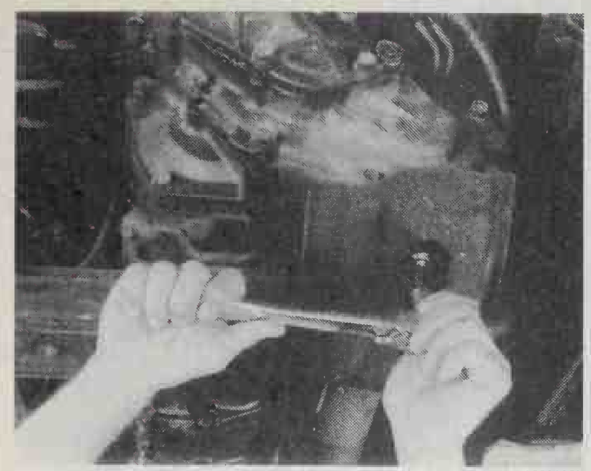

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Fig. 217 This truck has a bracket/shield where you access the plug through. You may need an extension

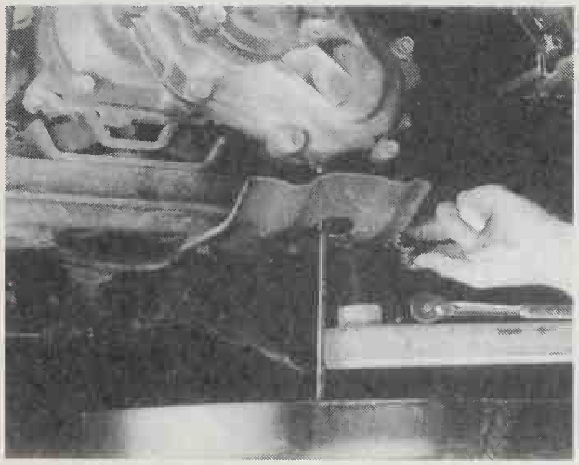

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Fig. 218 There will be just enough room to remove the plug with your hands. Be careful of the hot oil

Drive Axles

FLUID RECOMMENDATIONS

Hypoid gear oil API GL-5. Below 0°F (-18°C) use SAE 90W, above 0°F (-18°C) use SAE 80W or 80W-90.

LEVEL CHECK

Front

➧ See Figures 219, 220 and 221

The oil in the front differential should be checked at least every 7500 miles (12,000 km).

1. With the truck parked on a level surface, remove the filler plug from the back of the differential.

➡The plug on the bottom is the drain plug.

2. If the oil begins to trickle out of the hole, there is enough. Otherwise, carefully insert your finger (watch out for sharp threads) into the hole and check to see if the oil is up to the bottom edge of the filler hole.
3. If not, add oil through the hole until the level is at the edge of the hole. Most gear oils come in a plastic squeeze bottle with a nozzle, making additions simple.

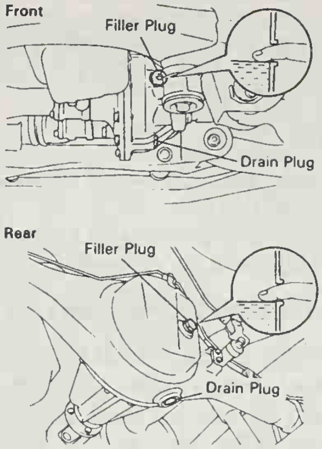

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Fig. 219 The front and rear filler plugs on most of your trucks are located in these areas shown

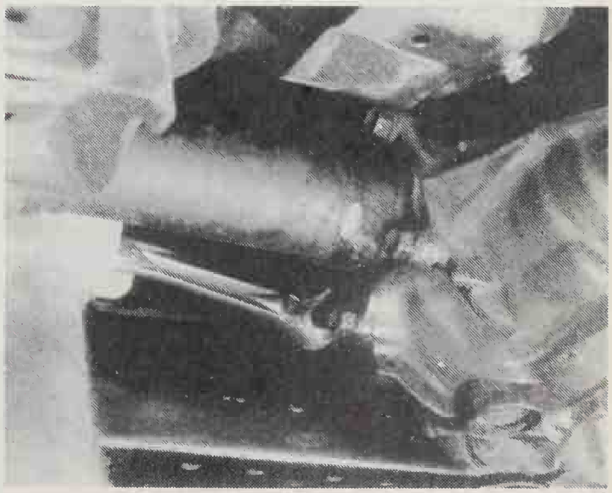

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Fig. 220 Locate the filler plug . . .

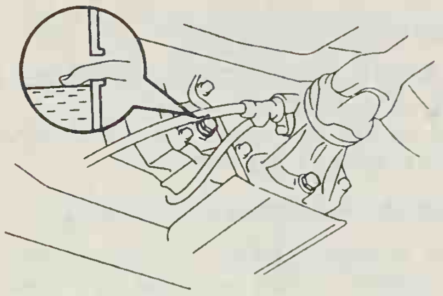

Fig. 221 . . . then check the level with your finger

4. Install the filler plug and drive the truck for a short distance. Stop the truck and check for leaks.

Rear

See Figure 222

The oil in the rear differential should be checked at least every 7500 miles (12,000 km).

1. With the truck parked on a level surface, remove the filler plug from the back of the differential.

➡The plug on the bottom is the drain plug.

2. If the oil begins to trickle out of the hole, there is enough. Otherwise, carefully insert your finger (watch out for sharp threads) into the hole and check to see if the oil is up to the bottom edge of the filler hole.
3. If not, add oil through the hole until the level is at the edge of the hole. Most gear oils come in a plastic squeeze bottle with a nozzle, making additions simple.
4. Install the filler plug and drive the truck for a short distance. Stop the truck and check for leaks.

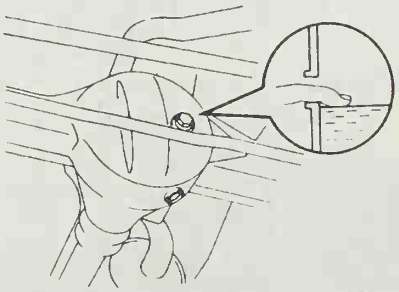

Fig. 222 Make sure you don't cut your finger, the threads can be sharp

DRAIN AND REFILL

Front

See Figures 223, 224 and 225

The gear oil in the front axle should be changed at least every 25,000-30,000 miles (40,000-48,000 km) or immediately if driven in deep water.

1. Park the vehicle on a level surface. Set the parking brake.
2. Clean the area around the drain plug.
3. Remove the filler (upper) plug. Place a container which is large enough to catch all of the differential oil under the drain plug.
4. Remove the drain (lower) plug and gasket, if so equipped. Allow all of the oil to drain into the container.
5. Install the drain plug. Tighten it so that it will not leak, but do not overtighten.
6. Refill with the proper grade and viscosity of axle lubricant. Be sure that the level reaches the bottom of the filler plug. DO NOT overfill.
7. Install the filler plug and check for leakage.

Rear

See Figures 226, 227, 228, 229 and 230

The gear oil in the rear axle should be changed at least every 25,000-30,000 miles (40,000-48,000 km) or immediately if driven in deep water.

1. Park the vehicle on a level surface. Set the parking brake.
2. Clean the area around the drain plug.
3. Remove the filler (upper) plug. Place a container which is large enough to catch all of the differential oil under the drain plug.
4. Remove the drain (lower) plug and gasket, if so equipped. Allow all of the oil to drain into the container.
5. Install the drain plug. Tighten it so that it will not leak, but do not overtighten.

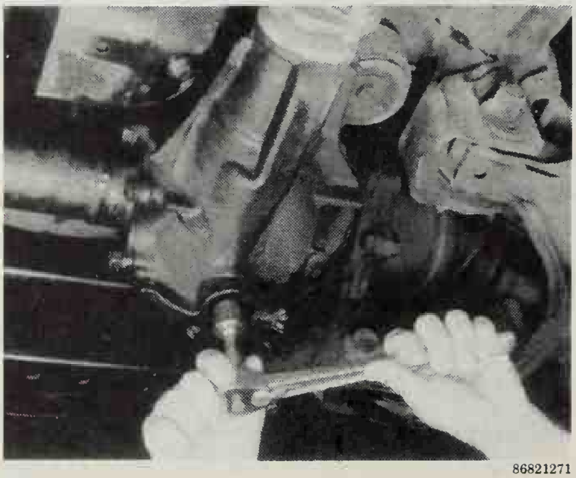

Fig. 223 Have a pan ready for the fluid about to flow from the axle

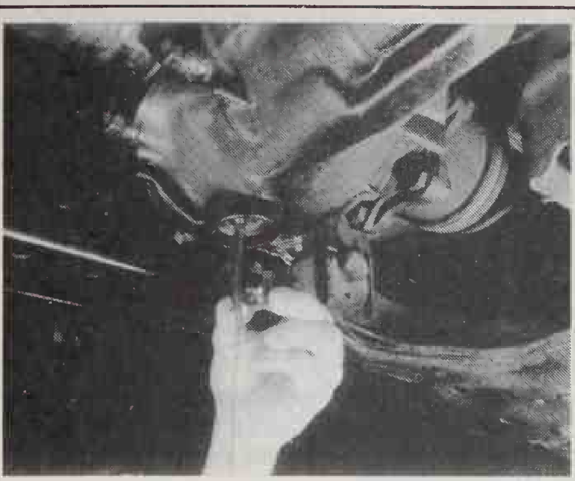

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Fig. 224 Remove the drain (lower) plug and gasket, if so equipped

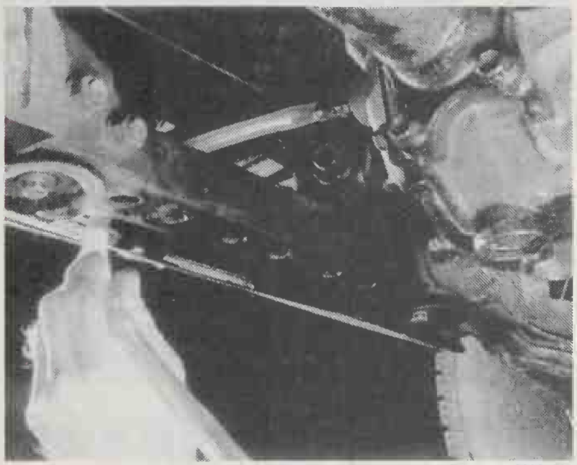

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Fig. 225 Slide a the pump's tube (shown) into the filler hole, or use bottled fluid with a built-in funnel

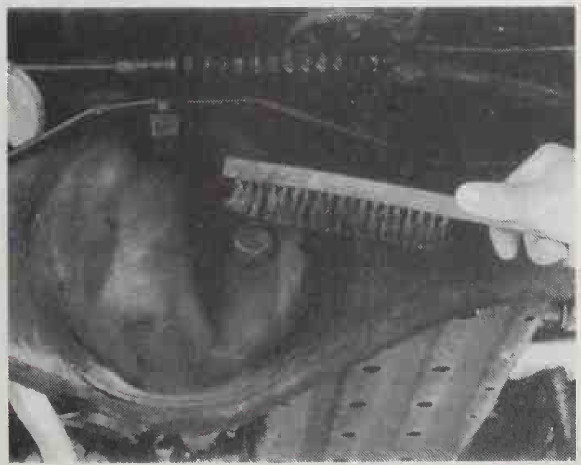

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Fig. 226 Clean the area around the drain plug — rear axle shown

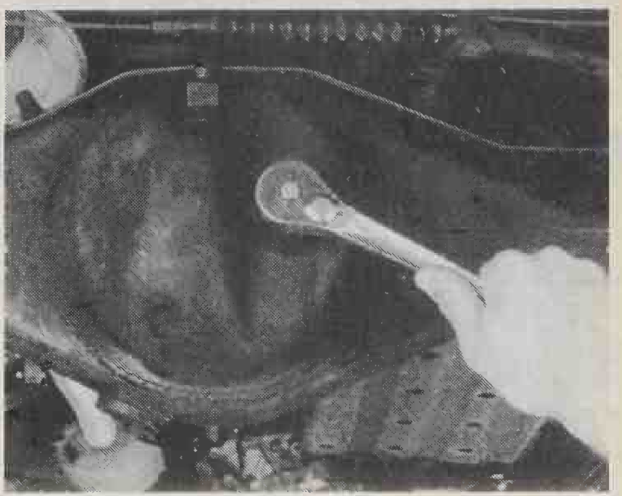

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Fig. 227 Unscrew the filler plug

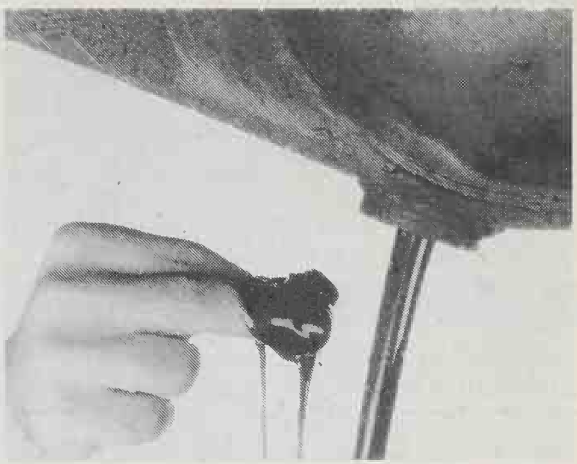

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Fig. 228 If you move quick enough, this won't happen to you

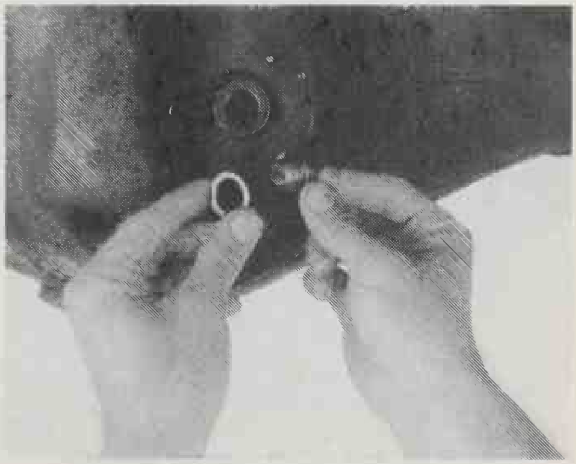

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Fig. 229 Install the filler (shown) and drain plugs along with the gaskets, securely

6. Refill with the proper grade and viscosity of axle lubricant. Be sure that the level reaches the bottom of the filler plug. DO NOT overfill.
7. Install the filler plug and check for leakage.

Cooling System

FLUID RECOMMENDATIONS

When additional coolant is required to maintain the proper level, always add a 50/50 mixture of ethylene glycol antifreeze/coolant and water. The use of supplementary inhibitors or additives is neither required nor recommended.

➡Do not use alcohol type antifreeze or plain water alone.

LEVEL CHECK

➧ See Figures 231, 232 and 233

Dealing with the cooling system can be a tricky matter unless the proper precautions are observed. All vehicles use a coolant reservoir tank (expansion tank) connected to the radiator by a small hose. Look through the plastic tank; the fluid level should be between FULL and LOW lines. Note that the FULL line is below the very top of the tank, allowing room for expansion. If the level in the tank is low, remove the cap of the tank and add coolant to the FULL line.

⁂CAUTION

Never remove the radiator cap to check fluid level; there is a high risk of scalding from escaping hot fluid.

If the coolant level is low, add an equal amount of ethylene glycol based antifreeze. Avoid using water that is known to have a high alkaline content or is very hard, except in emergency situations. Drain and flush the cooling system as soon as possible after using such water.

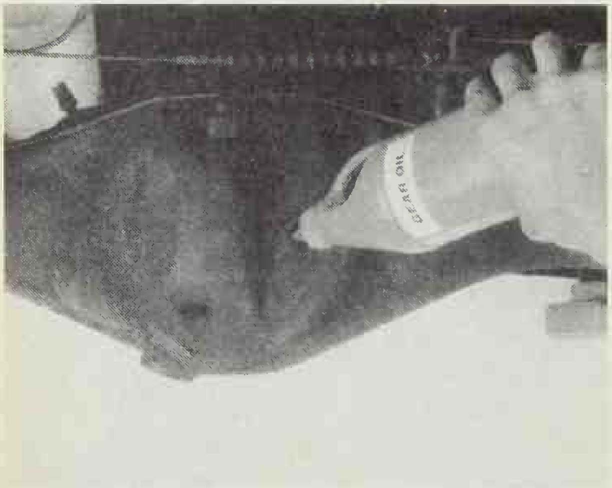

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Fig. 230 Refill the axle with the proper gear oil

The radiator hoses and clamps and the radiator cap should be checked at the same time as the coolant level. Hoses which are brittle, cracked, or swollen should be replaced. Clamps should be checked for tightness (screwdriver tight only.) Do not allow the clamp to cut into the hose or crush the fitting. The radiator cap gasket should be checked for any obvious tears, cracks or swelling, or any signs of incorrect seating in the radiator neck.

A 50/50 mix of coolant concentrate and water will usually provide protection to -35°F (-37°C). Freeze protection may be checked by using a cooling system hydrometer. Inexpensive hydrometers may be obtained from a local auto supply store. Follow the directions packaged with the coolant hydrometer when checking protection.

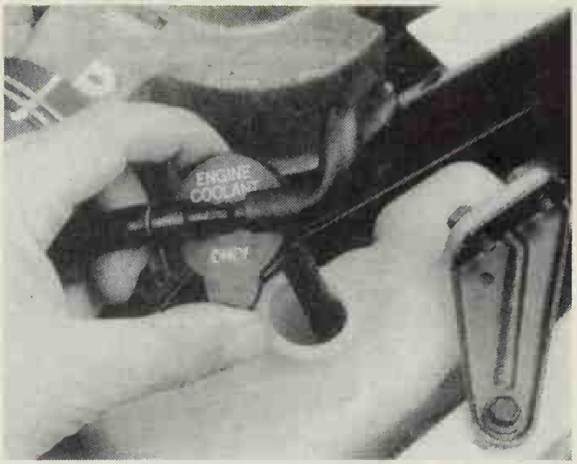

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Fig. 231 The engine coolant reservoir can be used for checking fluid level and adding coolant

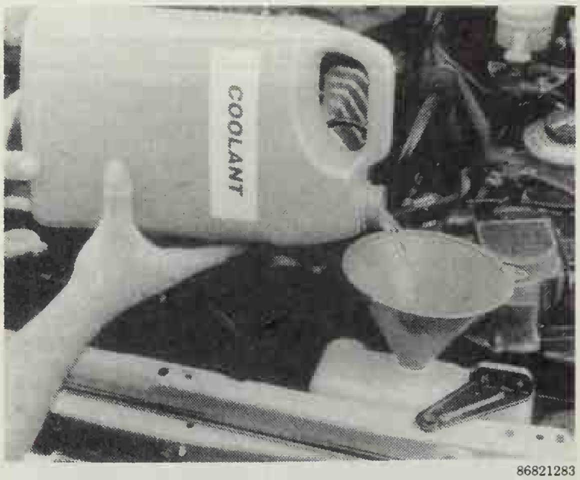

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Fig. 232 If the coolant is low, add an equal amount of ethylene glycol based antifreeze

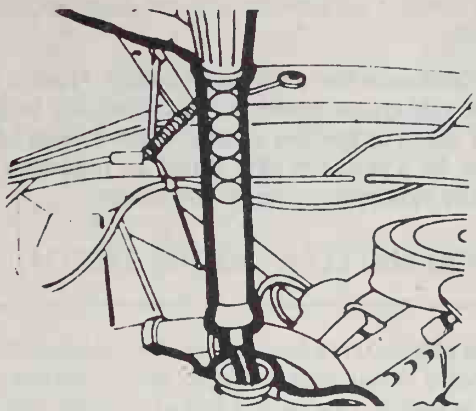


Fig. 233 A coolant hydrometer will show you the boiling and freezing points of the coolant present

DRAIN AND REFILL

➧ **See Figures 234, 235, 236, 237, 238 and 239**

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

Completely draining and refilling the cooling system every two years will remove accumulated rust, scale and other deposits.

1. Make certain the engine is COLD. Generally, this means at least 3 hours from last operation, longer in hot weather. Overnight cold is best.
2. Remove the radiator cap. Drain the existing antifreeze and coolant. Open the radiator and engine drain petcocks, or disconnect the bottom radiator hose at the radiator outlet. Set the heater temperature controls to the full HOT position.

➡Before opening the radiator petcock, spray it with some penetrating lubricant.

3. Close the petcocks or reconnect the lower hose and fill the system with the correct mixture of antifreeze and water in the correct amount. It will take a bit of time for the level to stabilize within the radiator.
4. Double check the petcocks for closure.
5. Install the radiator cap.
6. Flush the reservoir with water, empty it, then install fresh coolant mixture to the FULL line.
7. Start the engine, allowing it to idle. As it warms up, keep a close watch on the petcocks and/or hose fittings used to drain the system. If any leakage is seen, shut the engine **OFF** and fix the leak.

Fig. 234 When the engine is cool, remove the radiator cap

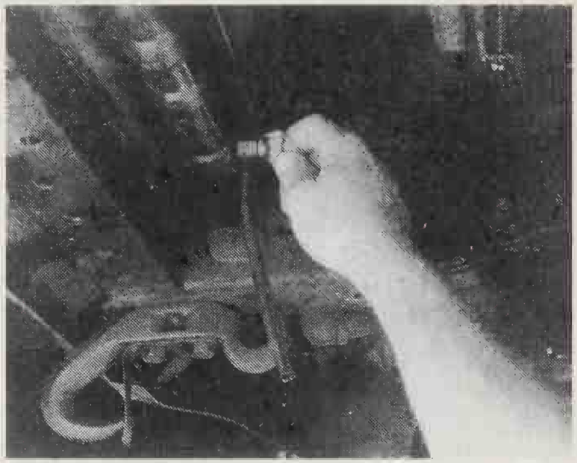


Fig. 235 The petcock or plug can be removed by turning it clockwise

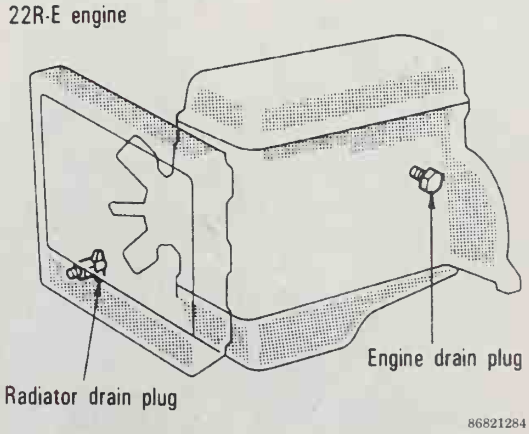


Fig. 236 Radiator and engine coolant plugs — 22R-E

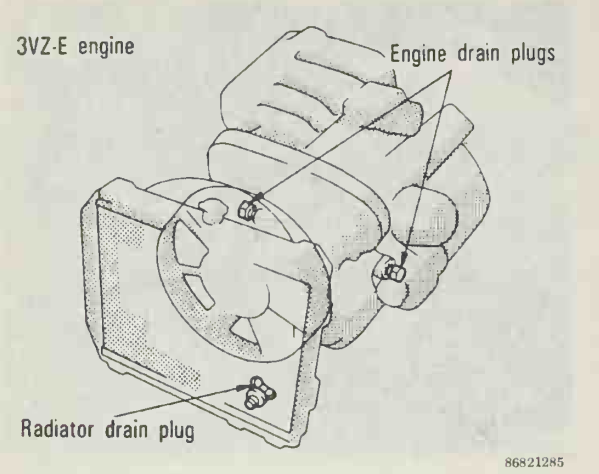


Fig. 237 Radiator and engine coolant plugs — 3VZ-E

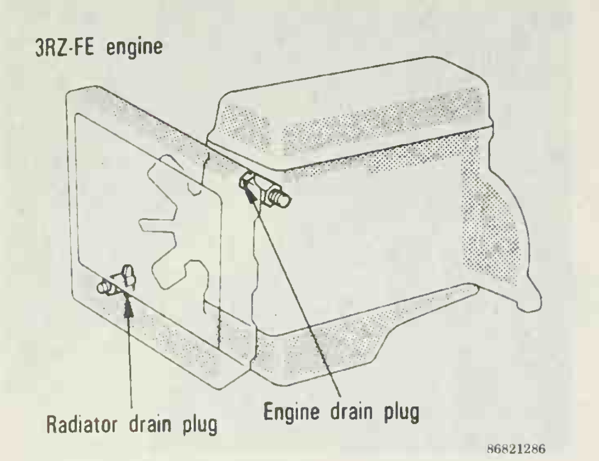


Fig. 238 Radiator and engine coolant plugs — 3RZ-FE

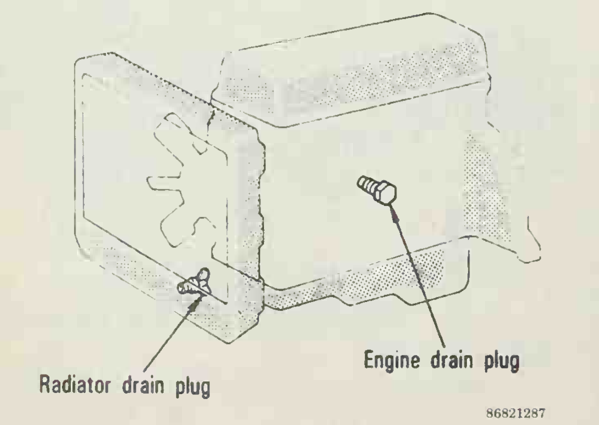


Fig. 239 Radiator and engine coolant plugs — 1FZ-FE

8. After the engine has warmed up, shut the engine **OFF**. Check the level in the reservoir tank and adjust the fluid level as needed.

➡Fresh antifreeze has a detergent quality. Fluid in the reservoir may appear muddy or discolored due to the cleaning action of the new coolant. If the system has been neglected for a period of time, it may be necessary to redrain the system to eliminate this sludge.

FLUSHING AND CLEANING THE SYSTEM

Several aftermarket radiator flushing and cleaning kits can be purchased at your local auto parts store. It is recommended that the radiator be cleaned and flushed of sludge and any rust build-up once a year. Manufacturers directions for proper use, and safety precautions, come in each kit.

CLEAN RADIATOR OF DEBRIS

Periodically clean any debris such as leaves, paper, insects, etc., from the radiator fins. Pick the large pieces off by hand. The smaller pieces can be washed away with water pressure from a hose.

Carefully straighten any bent radiator fins with a pair of needle nose pliers. Be careful, the fins are very soft. Don't wiggle the fins back and forth too much. Straighten them once and try not to move them again.

Master Cylinder (Brake and Clutch)

➧ See Figures 240 and 241

All models have the brake master cylinder reservoir on the left side of the firewall under the hood. Trucks and 4Runner's with manual transmissions use a hydraulic (fluid actuated) clutch. The clutch fluid reservoir is located in the same area as brake reservoir. The clutch master cylinder uses the same fluid as the brakes, and should be checked at the same time as the brake master cylinder.

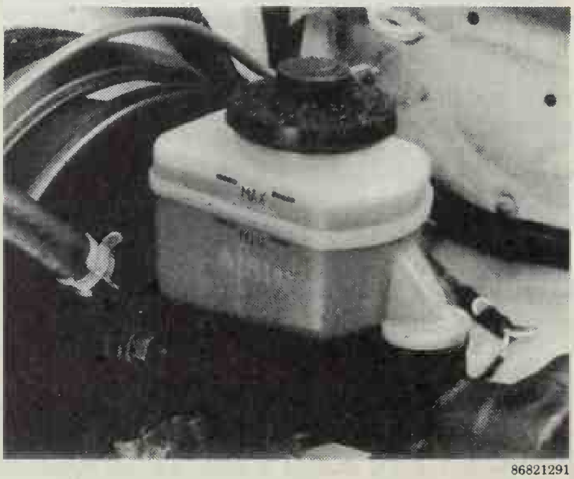


Fig. 240 The brake master cylinder is attached to the booster

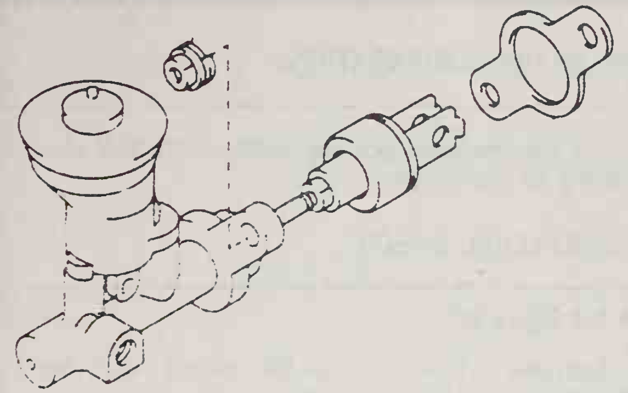


Fig. 241 The clutch master cylinder is located next to the brake master

FLUID RECOMMENDATIONS

Use only Heavy Duty Brake fluid meeting DOT 3 or SAE J1703 specifications.

LEVEL CHECK

See Figures 242, 243, 244 and 245

The fluid in the brake and/or clutch master cylinders should be checked every 6 months or 6000 miles (9600 km). Check the fluid level at the side of the reservoir. If fluid is required, thoroughly wipe the top of the reservoir and the sides of the plastic housing with a rag before opening. The fluid must be kept free from dirt and grit. Fill the reservoir to the MAX line in the reservoir. Never overfill the reservoir. Install the reservoir cap, making sure the gasket is properly seated in the cap.

WARNING

Brake fluid damages painted surfaces. If any fluid is spilled, immediately clean it off with plenty of clean water. It also absorbs moisture from the air; never leave a container of fluid or the master cylinder or the clutch cylinder uncovered any longer than necessary.

It is normal for the fluid level to fall as the disc brake pads wear. However, if the master cylinder requires filling frequently, you should check the system for leaks in the hoses, master cylinder, or wheel cylinders.

Power Steering Pump

FLUID RECOMMENDATIONS

Use only DEXRON®II or its superceding type automatic transmission fluid in the power steering system.

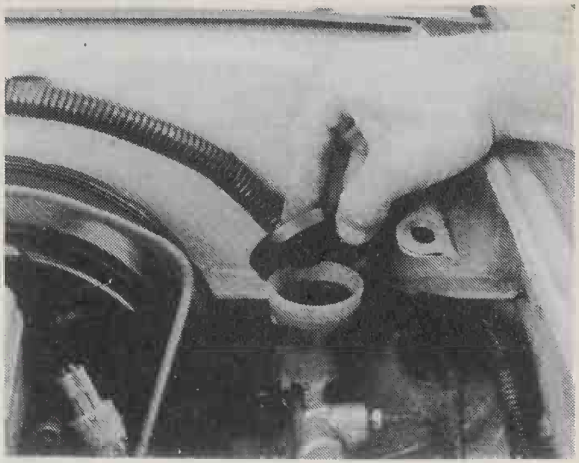


Fig. 242 Check the fluid level on the side of the reservoir. If necessary, lift the cap . . .

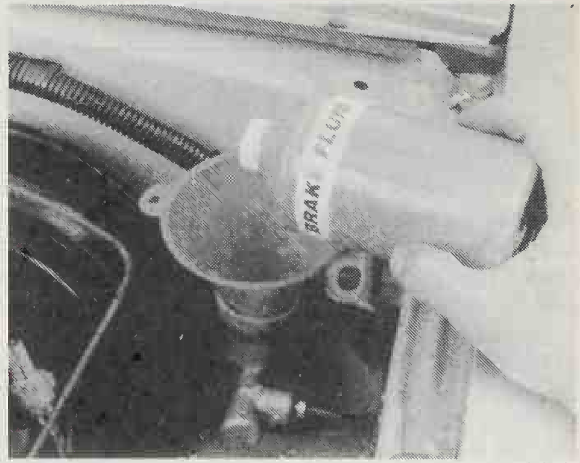


Fig. 243 . . . then fill to the appropriate line with DOT 3 fluid

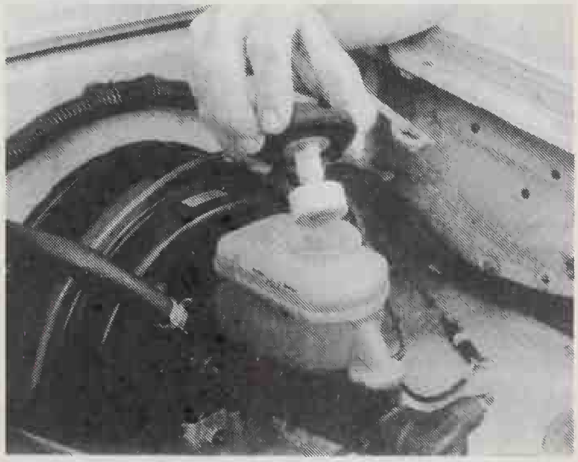


Fig. 244 As you can see on this brake master cylinder reservoir the level is slightly low

BRAKE FLU
86821296

Fig. 245 With the aid of a funnel, there will be little or no mess

FLUID LEVEL CHECK

▶ See Figure 246

Check the power steering fluid level every 6 months or 6000 miles (9600 km).

1. Park the vehicle on a level surface. Run the engine until normal operating temperature is reached.
2. Turn the steering all the way to the left and then all the way to the right several times. Center the steering wheel and shut off the engine.
3. Open the hood.
4. Remove the filler cap on the power steering fluid reservoir and wipe the dipstick clean.
5. Reinsert the dipstick and tighten the cap. Remove the dipstick and note the fluid level indicated on the dipstick.
6. The level should be at any point below the Full mark, but not below the Add mark (in the HOT or COLD ranges).
7. Add fluid as necessary. Do not overfill.

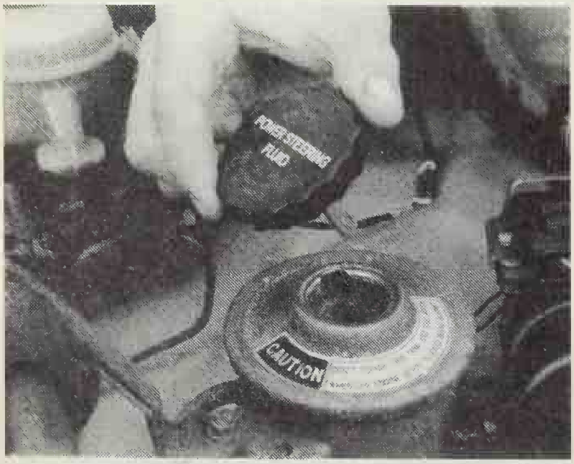


Fig. 246 Remove the filler cap on the power steering fluid reservoir and wipe the dipstick clean

Steering Gear

FLUID RECOMMENDATIONS

Use standard hypoid-type gear oil GL-4, SAE 90W when refilling the steering gear.

FLUID LEVEL CHECK

▶ See Figure 247

Each year or 15,000 miles (24,000 km) you should check the steering gear housing lubricating oil. The filler plug is on top of the housing and requires a 14mm wrench for removal. The level should be ¾-1 inch (18-28mm) from the top on 2WD models and 9/16-11/16 inch (14-17mm) from the top on 4WD models.

Chassis Greasing

▶ See Figures 248, 249, 250 and 251

Complete chassis greasing should include an inspection of all rubber suspension bushings, as well as proper greasing of the front suspension upper and lower ball joints and control arm bushings. To provide correct operation, the chassis should be greased with every oil and filter change or 7500 miles (12,070 km).

If you wish to perform this operation yourself, purchase a cartridge type grease gun and several cartridges of multipurpose lithium grease. Push the nozzle of the grease gun down firmly onto the fitting and while applying pressure, force the new grease into the fitting. Force sufficient grease into the fitting to cause some old grease to be expelled. Use an old rag to wipe off expelled grease; keep the fittings and joints free of globs of grease.

Four wheel drive vehicles have several lubrication points within the driveshaft and driveline. Some of these fittings are tucked into hard to see places; make certain each one is

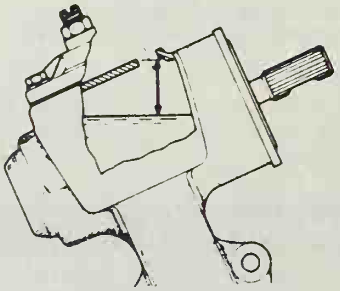


Fig. 247 Measure the distance from the top of the gearbox to the fluid as shown

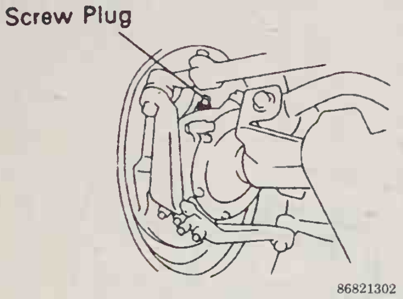


Fig. 248 On the steering knuckles; there is a screw plug to be removed and lubricated

accounted for. Additionally, 1989-90 Land Cruisers have lube fittings at the ends of the relay rods in the steering system. The 1991-96 Land Cruisers use permanently sealed joints; no lubrication is necessary.

MANUAL TRANSMISSION AND CLUTCH LINKAGE

On models so equipped, apply a small amount of chassis grease to the pivot points of the transmission and clutch linkage.

AUTOMATIC TRANSMISSION LINKAGE

On models so equipped, apply a small amount of 10W engine oil to the kickdown and shift linkage at the pivot points.

PARKING BRAKE LINKAGE

At yearly intervals or whenever binding is noticeable in the parking brake linkage, lubricate the cable guides, levers and linkage with a suitable chassis grease.

Body Lubrication and Maintenance

Door handles, hinges, and locks should be lubricated at least once a year. Use a light lithium grease for hinges and handles. Use spray graphite for door locks. Do not inject oil into door locks; it attracts and holds dirt and grit, causing binding and stiff operation, particularly in cold weather.

Additionally, a small amount of grease should be applied to the hood and trunk latches and hinges periodically. Other moving components such as seat back pivots or cargo compartments should be attended to on as-needed basis.

➡When performing lubrication of any item in the passenger area (doors, locks, etc.) apply lubricant sparingly and thoroughly wipe up the excess to prevent lubricant getting onto upholstery and/or clothing.

EXTERIOR CARE

Keep the exterior of the vehicle clean. Dirt can cause small scratches in the paint and the chemicals in road dirt and air pollution can cause paint damage. Frequent washing is recommended; this is particularly important for vehicles used in snowy areas, near salt water or any vehicle used off the road.

Wash the vehicle in the shade when the body is not hot to the touch. Wash with mild car-wash soap and rinse thoroughly before the soap dries on the paint. It may be necessary to wash and rinse the vehicle in sections to prevent the soap from streaking the paint. Never use gasoline or strong solvents to clean painted surfaces.

Use a chamois or soft, lint-free rag to dry the exterior. Wring the drying rag out frequently and keep it away from areas in which it may pick up dirt or grit. If the rag or chamois is dropped on the ground, rinse it thoroughly before continuing; it may carry grit which will scratch the finish.

After the paint is completely dry, the bodywork may be waxed with any of the commercial car polishes or waxes. Read the can carefully before purchase; use good judgment in deciding the condition of the finish. A wax for older finishes will have more abrasive to remove oxidized paint. A "new car" wax will have much less abrasive.

Wheel Bearings

➡Front wheel bearings on 4WD vehicles are covered in Section 7. Do not attempt to disassemble the bearings and hubs on these vehicles without referring to the appropriate procedures.

Only the front wheel bearings require periodic service. The lubricant to use is high temperature disc brake wheel bearing grease meeting NLGI No. 2 specifications. This service is recommended at 30,000 miles (48,270 km) on trucks, 4Runner's and 1991-96 Land Cruisers. On 1989-90 Land Cruisers, the interval is 26,500 miles (42,638 km). In either case, if the mileage is not achieved, the bearings should be packed every 36 months or whenever the truck has been driven in water up to the hub.

Before handling the bearings there are a few things that you should remember:

- Remove all outside dirt from the housing before exposing the bearing.
- Treat a used bearing as gently as you would a new one.
- Work with clean tools in clean surroundings.
- Use clean, dry canvas gloves, or at least clean, dry hands.
- Clean solvents and flushing fluids are a must.
- Use clean paper when laying out the bearings to dry.
- Protect disassembled bearings from rust and dirt. Cover them up.
- Use clean rags to wipe bearings.
- Keep the bearings in oil-proof paper when they are to be stored or are not in use.
- Clean the inside of the housing before replacing the bearings.

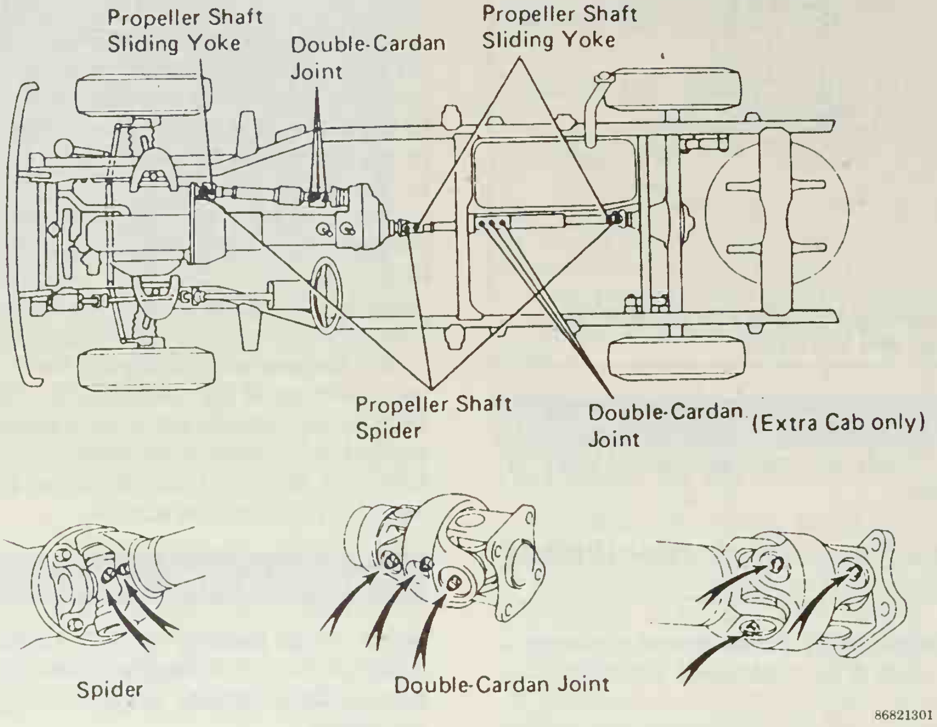

Propeller Shaft
Sliding Yoke
Double-Cardan
Joint
Propeller Shaft
Sliding Yoke
Propeller Shaft
Spider
Double-Cardan
Joint
(Extra Cab only)
Spider
Double-Cardan Joint
86821301

Fig. 249 Grease points on most of the truck and 4Runner's

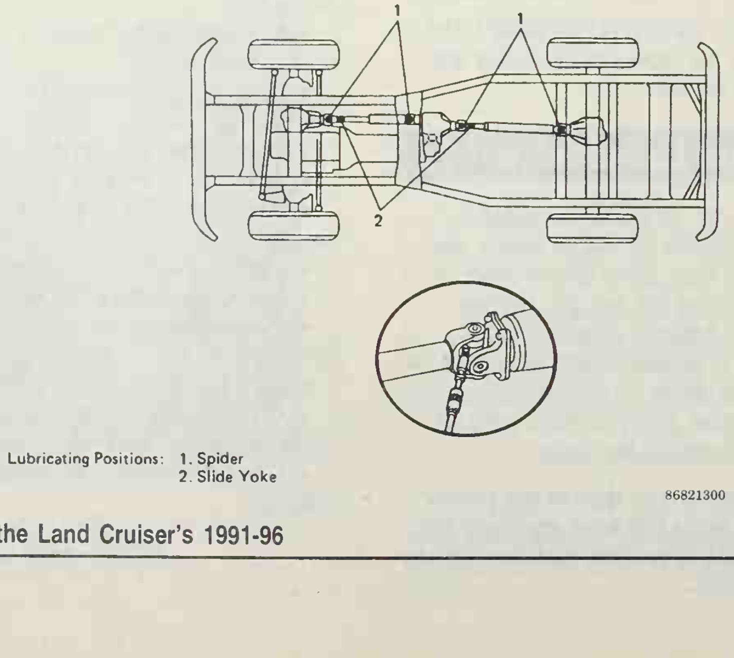

1
1
2
Lubricating Positions: 1. Spider
2. Slide Yoke
86821300

Fig. 250 Grease points on the Land Cruiser's 1991-96

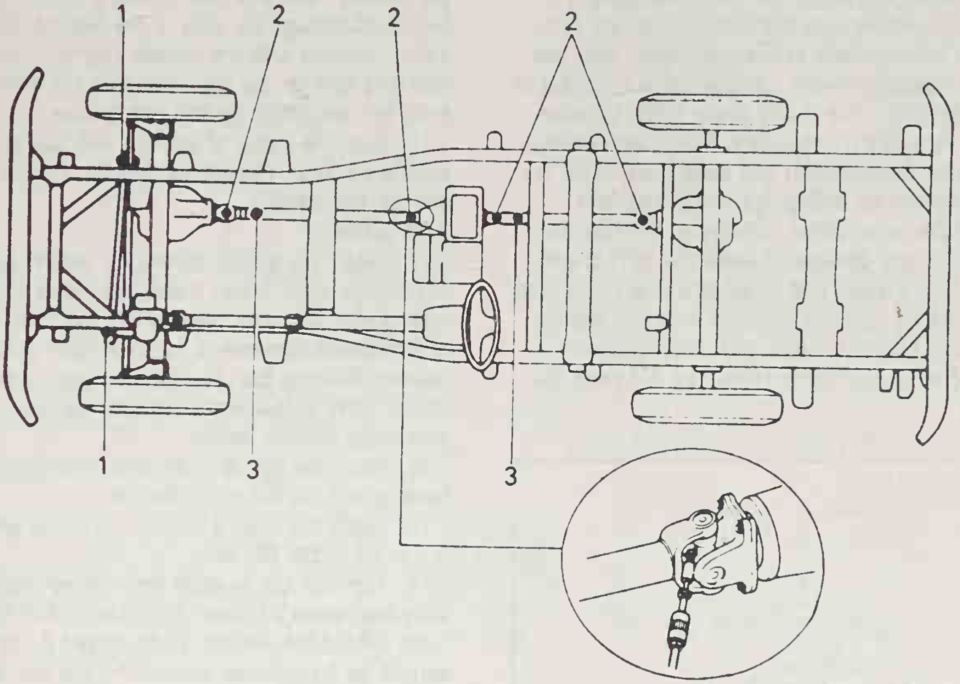


Fig. 251 Grease points on the Land Cruiser's 1989-90

Do NOT do the following:

- Don't work in dirty surroundings.
- Don't use dirty, chipped, or damaged tools.
- Try not to work on wooden work benches or use wooden mallets.
- Don't handle bearings with dirty or moist hands.
- Do not use gasoline for cleaning; use a safe solvent.
- Do not spin dry bearings with compressed air. They will be damaged.
- Do not spin unclean bearings.
- Avoid using cotton waste or dirty cloths to wipe bearings.
- Do not to scratch or nick bearing surfaces.
- Do not allow the bearing to come in contact with dirt or rust at any time.

REMOVAL, PACKING, AND INSTALLATION

2 Wheel Drive

➧ See Figures 252, 253, 254, 255 and 256

1. Loosen the lugnuts.
2. Elevate and safely support the front of the truck on jackstands.
3. Remove the wheels.
4. Remove the brake caliper from its mount. Use stiff wire to suspend it out of the way; do not loosen the brake hose at the caliper. Remove the brake pads.

⁂CAUTION

Brake pads contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

5. Remove the grease cap. Remove the cotter pin and locknut. Use a socket of the correct size to loosen and remove the axle nut.

6. Remove the hub and brake disc together with the outer bearing and thrust washer. Use your thumbs to keep the pieces inside the hub as the unit is removed. Be careful not to drop the outer bearing.

7. Use a small prying tool to remove the inner bearing seal. Once the seal is out, remove the bearing from the hub.

8. Place all both bearings and all the nuts, caps, etc., into a wide container of cleaning solvent. Cleanliness is essential to wheel bearing maintenance. Use a soft bristle brush to clean every bit of grease from every component. Place each cleaned component on a clean, lint-free cloth and allow them to air dry.

9. Inspect the bearings for pitting, flat spots, rust, and rough areas. Check the races (inner surfaces of the hub) for the same conditions. If any damage is seen, the components must be replaced. As a general rule, if either a bearing or race is damaged, the matching part that contacts it should also be replaced. Replacement bearings, seals and other required parts can be bought at an auto parts store. The old parts that are to be replaced should be taken along to be compared with the replacement part to insure a perfect match.

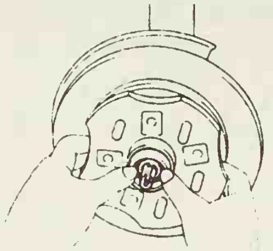


Fig. 252 Use your thumbs to keep the parts inside the hub as the unit is removed

To pack:

10. Pack the wheel bearings with grease. There are special devices made for the specific purpose of greasing bearings, but if one is not available, pack the wheel bearings by hand. Put a large dab of grease in the palm of your hand and push the bearing through it with a sliding motion. The grease must be forced through the side of the bearing and in between each roller. Continue until the grease begins to ooze out the other side and through the gaps between the rollers; the bearing must be completely packed with grease.

11. Coat the inside of the hub and cap with grease, but do not pack it solid. Remember that the spindle (axle) has to pass through the center.

To install:

12. Clean the spindle thoroughly and inspect it for any sign of damage. Coat it with a very light layer of bearing grease.

13. Install the inner bearing into the race. Use a seal driver of the correct diameter to install a NEW grease seal over the bearing. Reusing the old seal may cost more money than it saves; if the grease leaks out and the bearing fails, the wheel may seize while in motion.

14. Place the hub and disc onto the spindle. Install the outer bearing and the flat thrust washer.

15. Install the locknut and use a torque wrench to adjust the nut to 25 ft. lbs. (34 Nm).

16. Turn the hub in each direction several times to seat and snug the bearing. Loosen the locknut until it can be turned by hand without the wrench. Don't loosen it any more than necessary to be finger-loose. (Loosening the nut takes the pre-tension off the bearing.)

17. Use a spring tension scale to measure the force needed to turn the hub. Record the number.

18. Tighten the nut until the force required to turn the hub is:

- Single rear wheel vehicles — 1.3-4 lbs. (0.6-1.8 kg)
- Dual rear wheel vehicles — 0.9-2.2 lbs. (0.4-1 kg)

19. Install the locknut, cotter pin and grease cap. Make certain the cap is not crooked or loose.

20. Install the brake pads and caliper.

21. Install the wheel and lugnuts (hand-tight). Lower the vehicle to the ground and tighten the lugnuts.

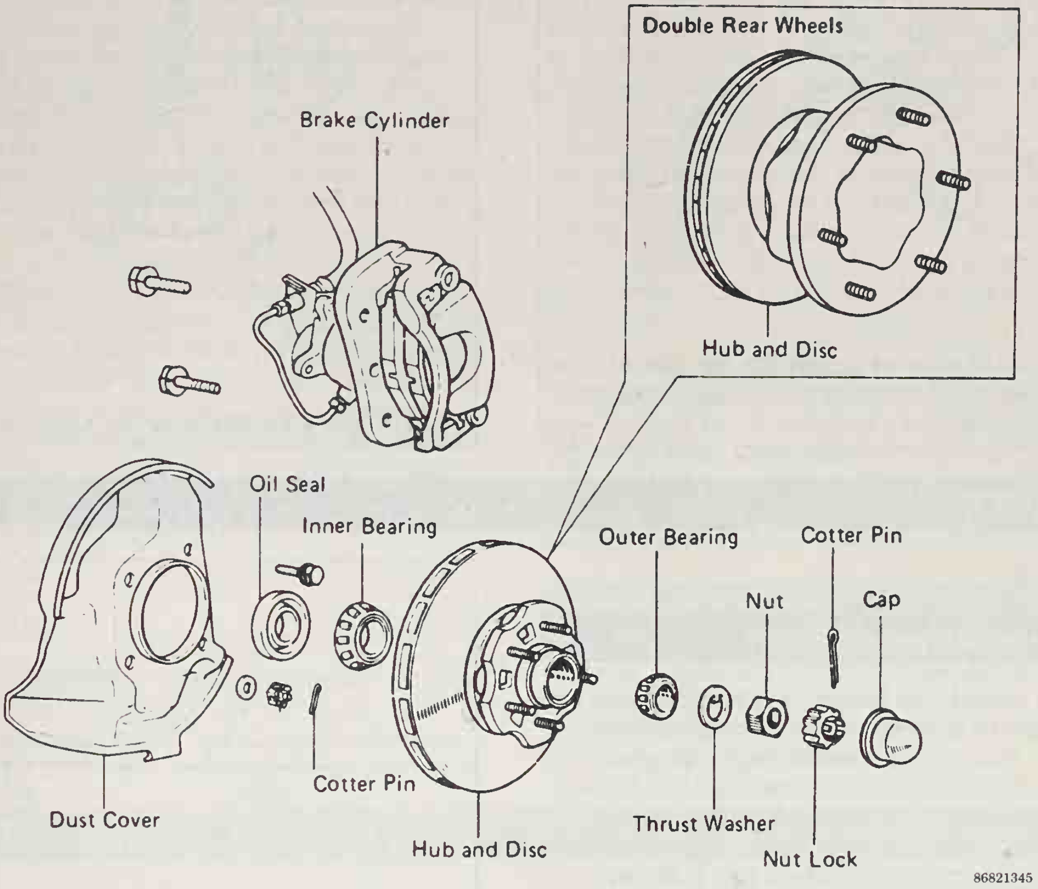

Double Rear Wheels
Hub and Disc
Brake Cylinder
Oil Seal
Inner Bearing
Outer Bearing
Cotter Pin
Nut
Cap
Cotter Pin
Dust Cover
Hub and Disc
Thrust Washer
Nut Lock
86821345

Fig. 253 Exploded view of the 2WD front wheel bearing components

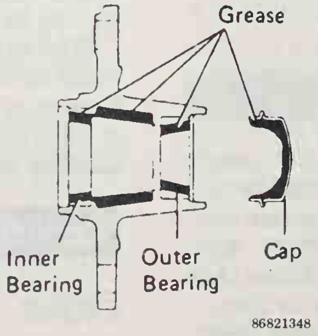

Grease
Inner Bearing
Outer Bearing
Cap
86821348

Fig. 254 These areas should be cleaned and regreased during front wheel bearing maintenance

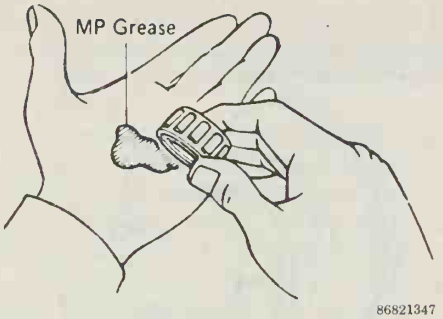


Fig. 255 Put a large dap of grease into the palm of your hand, then move the bearing in a sliding motion through the grease

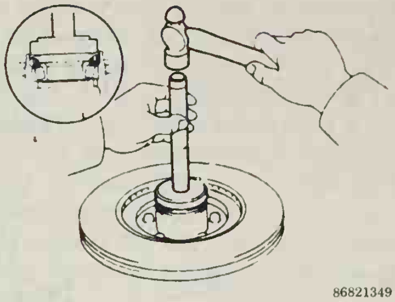


Fig. 256 Use a suitable driver to install the grease seal

TRAILER TOWING

➧ **See Figure 257**

General Recommendations

Your vehicle was primarily designed to carry passengers and cargo. It is important to remember that towing a trailer will place additional loads on your vehicle's engine, drive train, steering, braking and other systems. However, if you find decide to tow a trailer, using the proper equipment is a must.

Local laws may require specific equipment such as trailer brakes or fender mounted mirrors. Check your local laws.

Trailer Weight

The weight of the trailer is the most important factor. A good weight-to-horsepower ratio is about 35:1, 35 lbs. of Gross Combined Weight (GCW) for every horsepower your engine develops. Multiply the engine's rated horsepower by 35 and subtract the weight of the vehicle passengers and luggage. The result is the approximate ideal maximum weight you should tow, although a a numerically higher axle ratio can help compensate for heavier weight.

Hitch (Tongue) Weight

Figure the hitch weight to select a proper hitch. Hitch weight is usually 9-11% of the trailer gross weight and should be measured with the trailer loaded. Hitches fall into various categories: those that mount on the frame and rear bumper, the bolt-on or weld-on distribution type used for larger trailers. Axle mounted or clamp-on bumper hitches should never be used.

Check the gross weight rating of your trailer. Tongue weight is usually figured as 10% of gross trailer weight. Therefore, a trailer with a maximum gross weight of 2000 lbs. will have a maximum tongue weight of 200 lbs. Class I trailers fall into this category. Class II trailers are those with a gross weight rating of 2000-3000 lbs., while Class III trailers fall into the 3500-6000 lbs. category. Class IV trailers are those over 6000 lbs. and are for use with fifth wheel trucks, only.

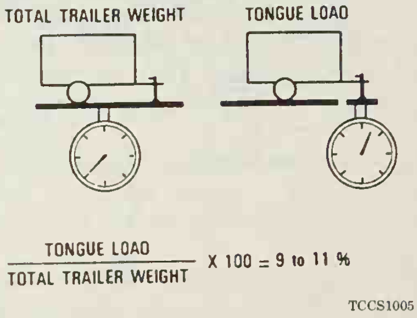


Fig. 257 Calculating proper tongue weight for you trailer

When you've determined the hitch that you'll need, follow the manufacturer's installation instructions, exactly, especially when it comes to fastener torques. The hitch will subjected to a lot of stress and good hitches come with hardened bolts. Never substitute an inferior bolt for a hardened bolt.

Cooling

ENGINE

One of the most common, if not THE most common, problems associated with trailer towing is engine overheating. If you have a standard cooling system, without an expansion tank, you'll definitely need to get an aftermarket expansion tank kit, preferably one with at least a 2 quart capacity. These kits are easily installed on the radiator's overflow hose, and come with a pressure cap designed for expansion tanks.

Another helpful accessory for vehicles using a belt-driven radiator fan is a flex fan. These fans are large diameter units are designed to provide more airflow at low speeds, with blades that have deeply cupped surfaces. The blades then flex, or flatten out, at high speed, when less cooling air is needed. These fans are far lighter in weight than stock fans, requiring less horsepower to drive them. Also, they are far quieter than stock fans. If you do decide to replace your stock fan with a flex fan, note that if your vehicle has a fan clutch, a spacer will be needed between the flex fan and water pump hub.

Aftermarket engine oil coolers are helpful for prolonging engine oil life and reducing overall engine temperatures. Both of these factors increase engine life. While not absolutely necessary in towing Class I and some Class II trailers, they are recommended for heavier Class II and all Class III towing. Engine oil cooler systems consists of an adapter, screwed on in place of the oil filter, a remote filter mounting and a multi-tube, finned heat exchanger, which is mounted in front of the radiator or air conditioning condenser.

TRANSMISSION

An automatic transmission is usually recommended for trailer towing. Modern automatics have proven reliable and, of course, easy to operate, in trailer towing. The increased load of a trailer, however, causes an increase in the temperature of the automatic transmission fluid. Heat is the worst enemy of an automatic transmission. As the temperature of the fluid increases, the life of the fluid decreases.

It is essential, therefore, that you install an automatic transmission cooler. The cooler, which consists of a multi-tube, finned heat exchanger, is usually installed in front of the radiator or air conditioning condenser, and hooked in-line with the transmission cooler tank inlet line. Follow the cooler manufacturer's installation instructions.

Select a cooler of at least adequate capacity, based upon the combined gross weights of the vehicle and trailer.

Cooler manufacturers recommend that you use an aftermarket cooler in addition to, and not instead of, the present cooling tank in your radiator. If you do want to use it in place of the radiator cooling tank, get a cooler at least two sizes larger than normally necessary.

➡A transmission cooler can, sometimes, cause slow or harsh shifting in the transmission during cold weather, until the fluid has a chance to come up to normal operating temperature. Some coolers can be purchased with or retrofitted with a temperature bypass valve which will allow fluid flow through the cooler only when the fluid has reached above a certain operating temperature.

Handling A Trailer

Towing a trailer with ease and safety requires a certain amount of experience. It's a good idea to learn the feel of a trailer by practicing turning, stopping and backing in an open area such as an empty parking lot.

TOWING THE VEHICLE

▸ See Figure 258

⁂WARNING

Push-starting is not recommended. All trucks are equipped with a catalytic converter. Raw gas collecting in the converter may cause damage. Additionally, computer controlled fuel injection system components may be damaged. Jump starting from a known good battery is the only recommended method of starting a disabled vehicle.

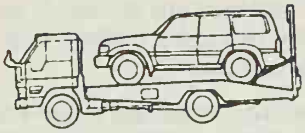
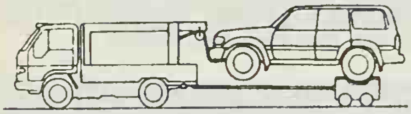
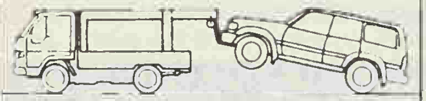
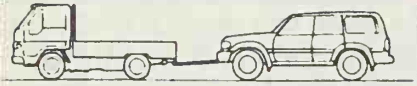
If a Toyota truck needs to be towed, the best way is to use a flatbed or rollback tow vehicle which can carry the vehicle with all 4 wheels off the ground.

Trucks and 4Runner's may also be towed with either end elevated. To tow with rear wheels on the ground, release the parking bake and put the transmission in NEUTRAL. The transfer case (if 4WD) must be in H2. The H4 button must be off. With automatic transmissions, the rear drive shaft must be disconnected at the differential if towing will exceed 30 mph (48 kph) or a total of 50 miles (80 km). Failure to disconnect the driveshaft will damage the transmission.

Towing trucks and 4Runner's with the front wheels on the ground requires the ignition key to be in the **ACC** position to release the steering lock. On 4WD units, put the transmission in NEUTRAL and the transfer case selector in H2. Disengage the free-wheeling hubs if so equipped. To tow with the front wheels on the ground, the steering wheel must be held in place with special equipment commonly carried on tow trucks. The anti-theft lock is not strong enough to hold the front wheels straight during towing.

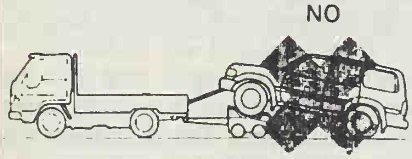
Land Cruisers may be towed in similar manners but in all cases the center differential switch must be OFF and the center differential set in the FREE position.

All vehicles are equipped with tow hooks front and rear which may be used for flat towing with a rope or chain. A driver must be in the vehicle to steer it and operate the brakes. Towing in this manner must only be done for a short distance at low speeds. The entire drive line, wheels, axles, etc., must be in serviceable condition. The transmission must be in NEUTRAL and, on 4WD models, the transfer case in H2. On Land Cruisers, switch the center differential lock OFF.

Condition / Towing Method	Parking Brake	Transmission Shift Lever Position	Transfer Shift Lever Position	(w/o ABS) Center Differential Lock Switch	Center Differential
① Flat Bed Truck 	Applied	"P" Range	"H" Position	OFF	FREE (Normal Driving)
② Sling-Type Tow Truck with Dollies 					
③ Sling-Type Tow Truck (Front wheels must be able to rotate freely) 	Released	"N" Range	"N" Position	OFF	↑
④ Towing with Rope 	Released	"N" Range	"N" Position	OFF	↑
	HINT: Do not tow the vehicle at a speed faster than 45 km/h (30 mph) or a distance greater than 80 km (50 miles).				

HINT: **Do not use any towing methods other than those shown above.**

For example, the towing method shown below is dangerous, so do not use it.



During towing with this towing method, there is a danger of the drive train heating up and causing breakdown, or of the front wheels flying off the dolly.

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Fig. 258 Towing a Full-time 4WD vehicle

JUMP STARTING A DEAD BATTERY

See Figure 259

Whenever a vehicle is jump started, precautions must be followed in order to prevent the possibility of personal injury. Remember that batteries contain a small amount of explosive hydrogen gas which is a by-product of battery charging. Sparks should always be avoided when working around batteries, especially when attaching jumper cables. To minimize the possibility of accidental sparks, follow the procedure carefully.

⁂WARNING

NEVER hook the batteries up in a series circuit or the entire electrical system will go up in smoke, especially the starter!

Jump Starting Precautions

- Be sure that both batteries are of the same voltage. Vehicles covered by this manual and most vehicles on the road today utilize a 12 volt charging system.
- Be sure that both batteries are of the same polarity (have the same terminal, in most cases NEGATIVE grounded).
- Be sure that the vehicles are not touching or a short could occur.
- On serviceable batteries, be sure the vent cap holes are not obstructed.
- Do not smoke or allow sparks anywhere near the batteries.
- In cold weather, make sure the battery electrolyte is not frozen. This can occur more readily in a battery that has been in a state of discharge.
- Do not allow electrolyte to contact your skin or clothing.

Jump Starting Procedure

1. Make sure that the voltages of the 2 batteries are the same. Most batteries and charging systems are of the 12 volt variety.
2. Pull the jumping vehicle (with the good battery) into a position so the jumper cables can reach the dead battery and that vehicle's engine. Make sure that the vehicles do NOT touch.
3. Place the transmissions of both vehicles in Neutral or Park, as applicable, then firmly set their parking brakes.

➡If necessary for safety reasons, the hazard lights on both vehicles may be operated throughout the entire procedure without significantly increasing the difficulty of jumping the dead battery.

4. Turn all lights and accessories off on both vehicles. Make sure the ignition switches on both vehicles are turned to the **OFF** position.
5. Cover the battery cell caps with a rag, but do not cover the terminals.
6. Make sure the terminals on both batteries are clean and free of corrosion or proper electrical connection will be impeded. If necessary, clean the battery terminals before proceeding.
7. Identify the positive (+) and negative (-) terminals on both battery posts.
8. Connect the first jumper cable to the positive (+) terminal of the dead battery, then connect the other end of that cable to the positive (+) terminal of the booster (good) battery.
9. Connect one end of the other jumper cable to the negative (-) terminal on the booster battery and the other cable clamp to an engine bolt head, alternator bracket or other solid, metallic point on the engine with the dead battery. Try to pick a ground on the engine that is positioned away from the battery in order to minimize the possibility of the 2 clamps touch-

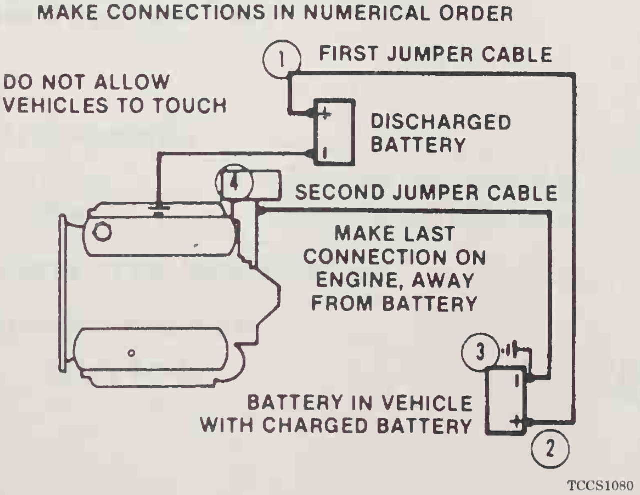

MAKE CONNECTIONS IN NUMERICAL ORDER
①
FIRST JUMPER CABLE
DO NOT ALLOW VEHICLES TO TOUCH
+
DISCHARGED BATTERY
④
SECOND JUMPER CABLE
MAKE LAST CONNECTION ON ENGINE, AWAY FROM BATTERY
③
BATTERY IN VEHICLE WITH CHARGED BATTERY
+
②
TCCS1080

Fig. 259 Connect the jumper cables to the batteries and engine in the order shown

ing should one loosen during the procedure. DO NOT connect this clamp to the negative (-) terminal of the bad battery.

⁂CAUTION

Be very careful to keep the jumper cables away from moving parts (cooling fan, belts, etc.) on both engines.

10. Check to make sure that the cables are routed away from any moving parts, then start the donor vehicle's engine. Run the engine at moderate speed for several minutes to allow the dead battery a chance to receive some initial charge.
11. With the donor vehicle's engine still running slightly above idle, try to start the vehicle with the dead battery. Crank the engine for no more than 10 seconds at a time and let the starter cool for at least 20 seconds between tries. If the vehicle does not start in 3 tries, it is likely that something else is also wrong or that the battery needs additional time to charge.
12. Once the vehicle is started, allow it to run at idle for a few seconds to make sure that it is operating properly operating.
13. Turn on the headlights, heater blower and, if equipped, the rear defroster of both vehicles in order to reduce the severity of voltage spikes and subsequent risk of damage to the vehicles' electrical systems when the cables are disconnected. This step is especially important to late model vehicles equipped with computer control modules.
14. Carefully disconnect the cables in the reverse order of connection. Start with the negative cable that is attached to the engine ground, then the negative cable on the donor battery. Disconnect the positive cable from the donor battery and finally, disconnect the positive cable from the formerly dead battery. Be careful when disconnecting the cables from the positive terminals not to allow the alligator clips to touch any metal on either vehicle or a short and sparks will occur.

JACKING

➧ See Figures 260, 261, 262, 263 and 264

Your vehicle was supplied with a jack for emergency road repairs. This jack is fine for changing a flat tire or other operations not requiring you to go beneath the vehicle. If it is used in an emergency situation, carefully follow the instructions provided either with the jack or in your owner's manual. Do not attempt to use the jack in any places other than specified by the vehicle manufacturer. Always block the diagonally opposite wheel when using a jack.

A more convenient way of jacking is the use of a garage or floor jack. Never place the jack under the radiator, engine or transmission components. Severe and expensive damage will result when the jack is raised. Additionally, never jack under the floorpan or bodywork; the metal will deform.

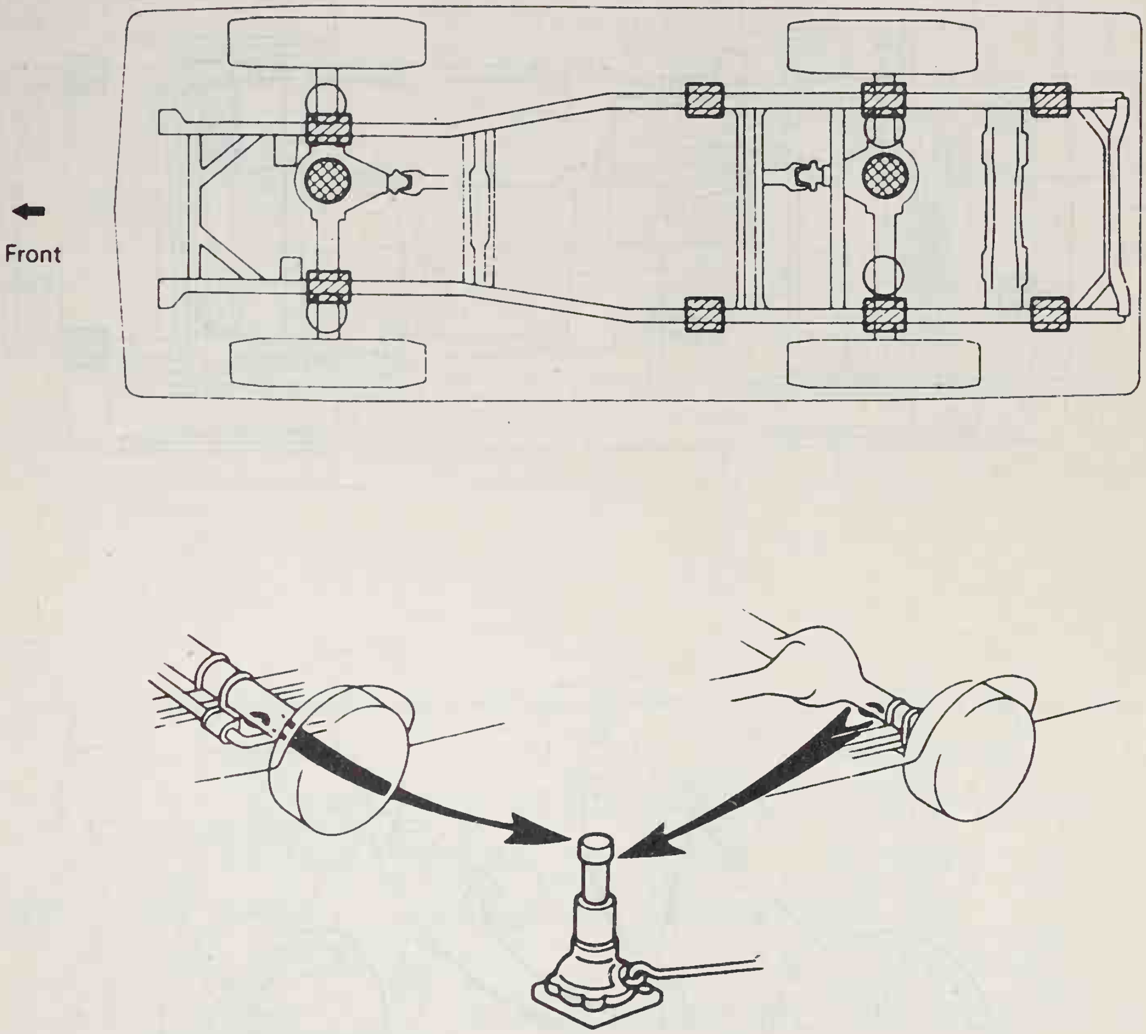
Whenever you plan to work under the vehicle, you must support it on jackstands or ramps. Never use cinder blocks or stacks of wood to support the vehicle, even if you're only going to be under it for a few minutes. Never crawl under the vehicle when it is supported only by the tire-changing jack or other floor jack.

➡Always position a block of wood on top of the jack or stand to protect the finish when lifting or supporting the vehicle.

Small hydraulic, screw, or scissors jacks are satisfactory for raising the vehicle. Drive-on trestles or ramps are also a handy and safe way to both raise and support the vehicle. Be careful though, some ramps may be too steep to drive your vehicle onto without scraping the front bottom panels. Never support the vehicle on any suspension member (unless specifically instructed to do so by a repair manual) or underbody panel.

The following safety points cannot be overemphasized:

- Always block the opposite wheel or wheels to keep the vehicle from rolling off the jack.
- When raising the front of the vehicle, firmly apply the parking brake.
- Always use jackstands to support the vehicle when you are working underneath. Place the stands beneath the scissors jacking brackets. Before climbing underneath, rock the vehicle a bit to make sure it is firmly supported.



JACK POSITION ———— ▩

Front .... Under the front differential
Rear .... Under the rear differential

SCREW TYPE JACK POSITION ———— ○

SUPPORT POSITION

Safety stand .... ▨

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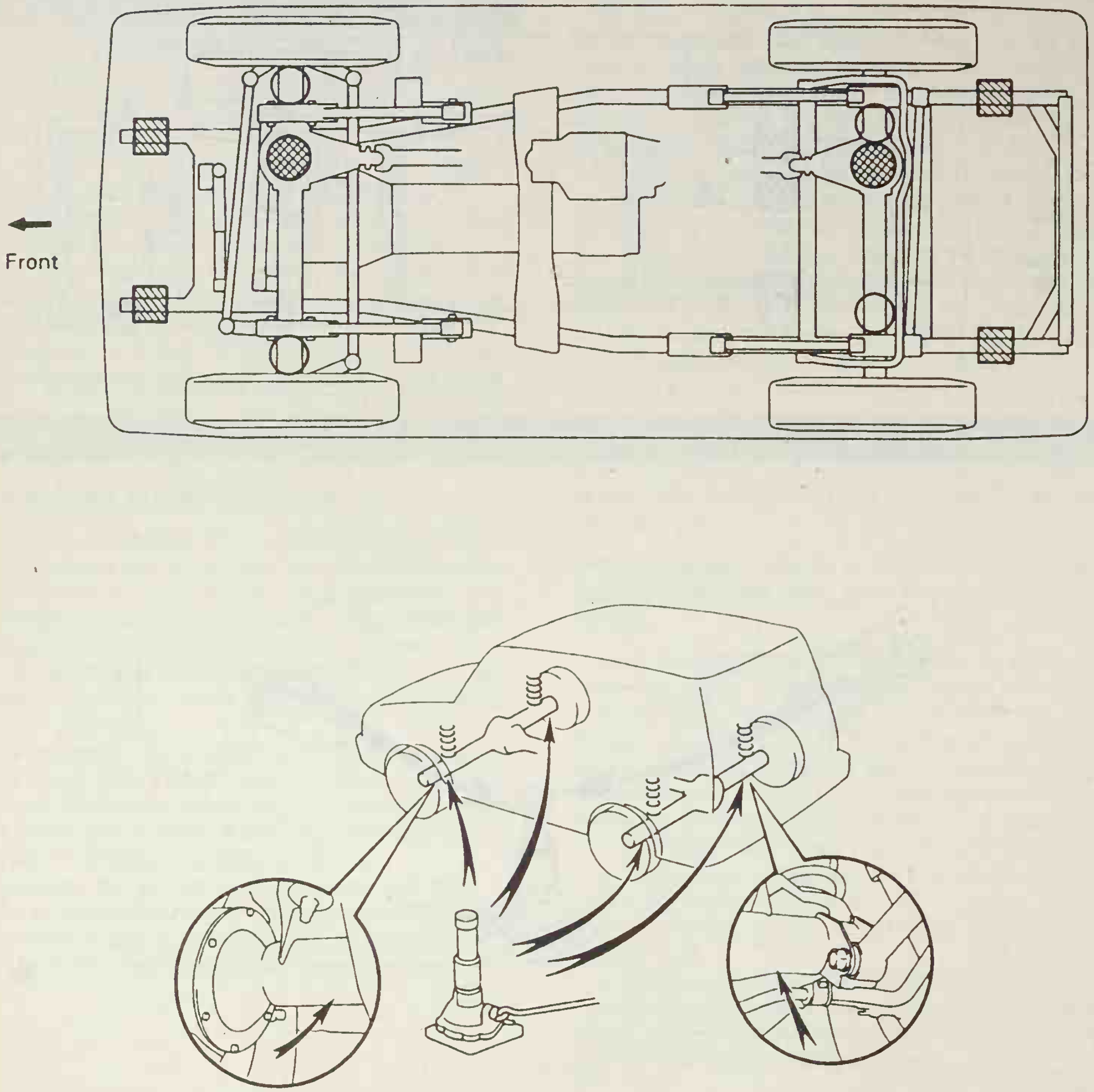
Fig. 260 Vehicle lift and support locations on the 1989-90 Land Cruiser's



JACK POSITION ●

Front .... Under the front differential

Rear .... Under the rear differential

SCREW TYPE JACK POSITION ○

SUPPORT POSITION

Safety stand .... ▨

Fig. 261 Vehicle lift and support locations on the 1991-96 Land Cruiser's

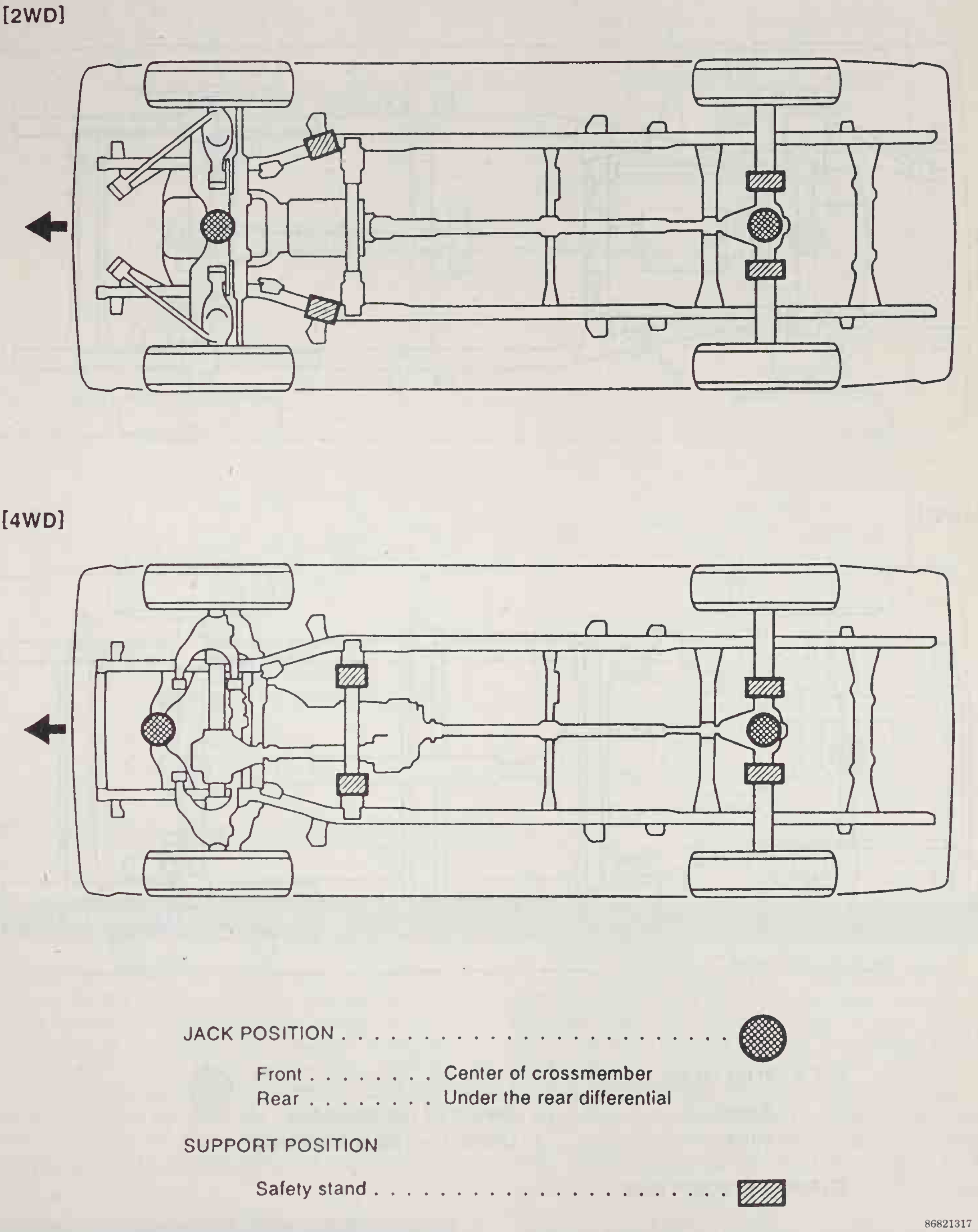

[2WD]
[4WD]
JACK POSITION . . . . ●
Front . . . . Center of crossmember
Rear . . . . Under the rear differential
SUPPORT POSITION
Safety stand . . . . ▨
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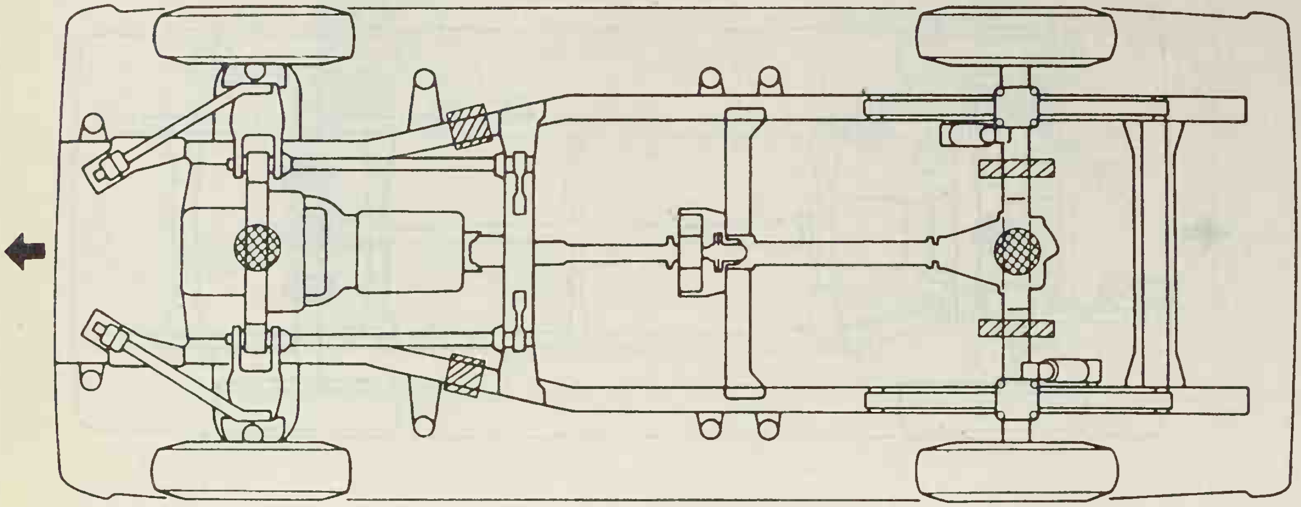
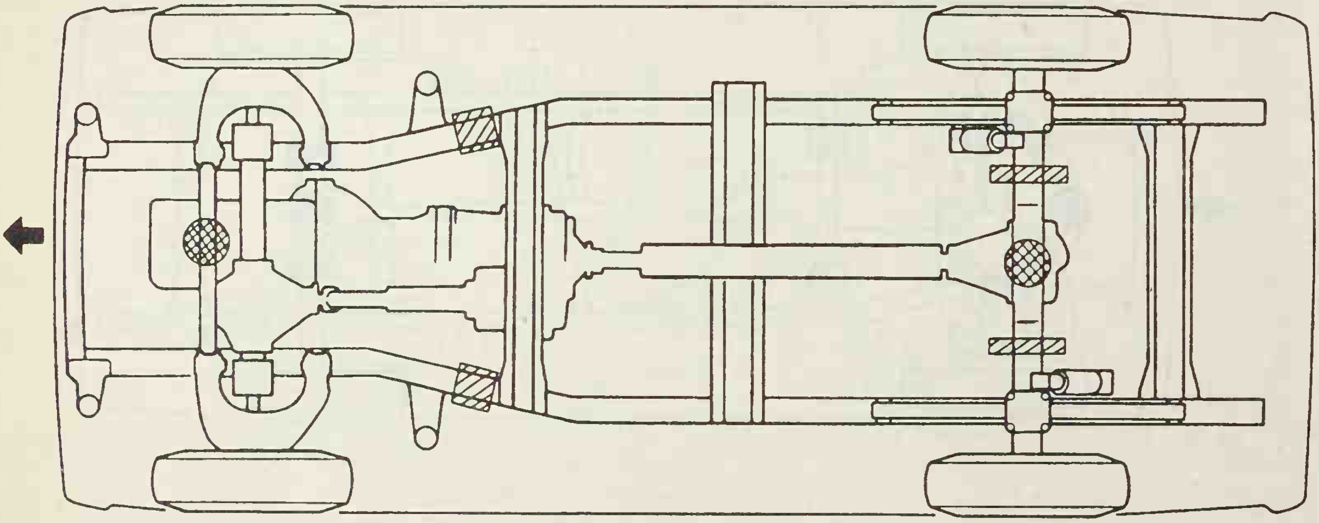
Fig. 262 Vehicle lift and support locations on the Tacoma's

[2WD]



[4WD]



JACK POSITION .... ▩

Front	Center of crossmember
Rear	Under the rear differential

SUPPORT POSITION

Safety stand .... ▨

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Fig. 263 Vehicle lift and support locations on the T100's

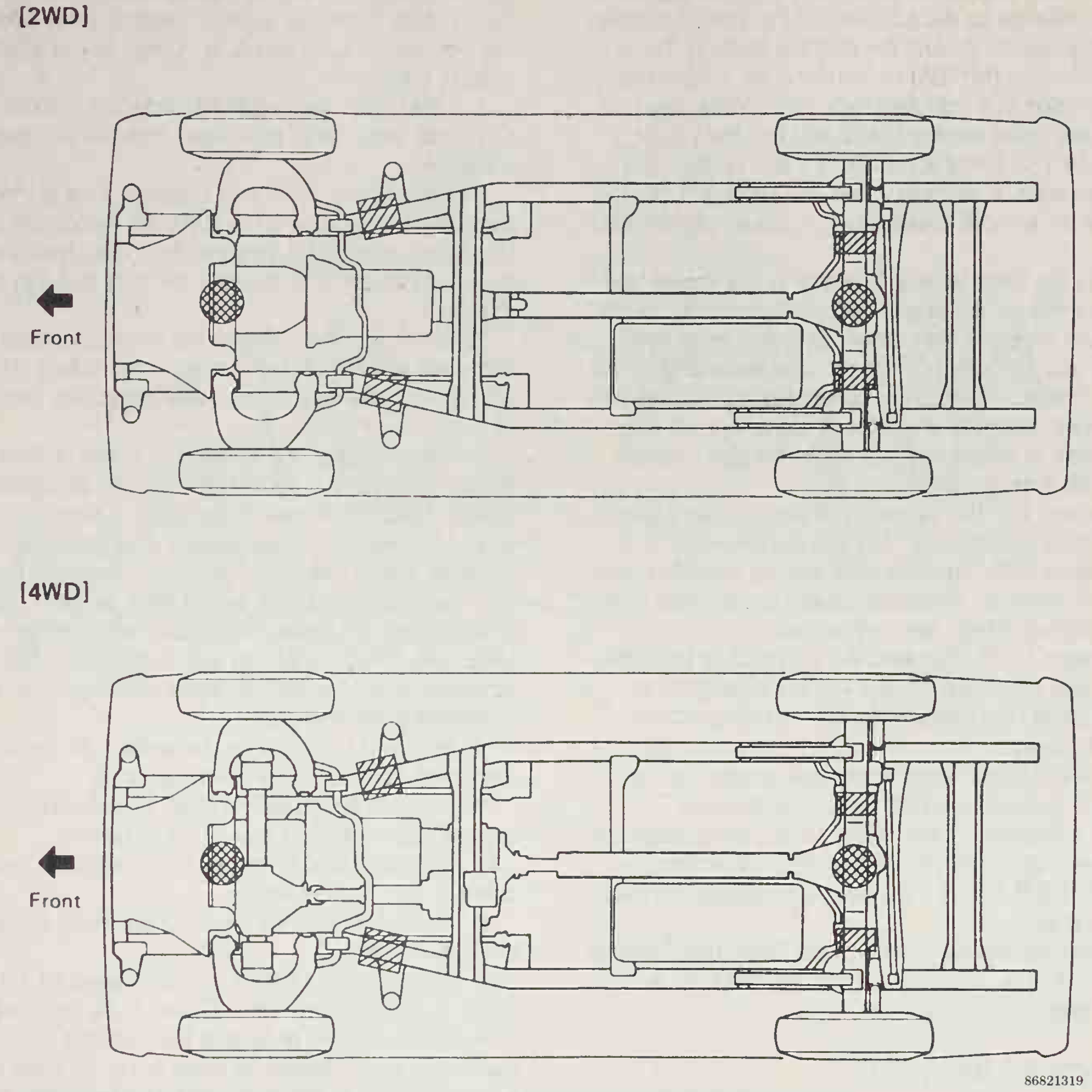

Fig. 264 Vehicle lift and support locations on the 1989-96 Pick-up's

HOW TO BUY A USED VEHICLE

Many people believe that a two or three year old used car or truck is a better buy than a new vehicle. This may be true as most new vehicles suffer the heaviest depreciation in the first two years and, at three years old, a vehicle is usually not old enough to present a lot of costly repair problems. But keep in mind, when buying a non-warranted automobile, there are no guarantees. Whatever the age of the used vehicle you might want to purchase, this section and a little patience should increase your chances of selecting one that is safe and dependable.

Tips

1. First decide what model you want, and how much you want to spend.
2. Check the used car lots and your local newspaper ads. Privately owned vehicles are usually less expensive, however, you may not get a warranty that, in many cases, comes with a used vehicle purchased from a lot. Of course, some aftermarket warranties may not be worth the extra money, so this is a point you will have to debate and consider based on your priorities.
3. Never shop at night. The glare of the lights make it easy to miss faults on the body caused by accident or rust repair.
4. Try to get the name and phone number of the previous owner. Contact him/her and ask about the vehicle. If the owner of a lot refuses this information, look for a vehicle somewhere else.

A private seller can tell you about the vehicle and maintenance. But remember, there's no law requiring honesty from private citizens selling used vehicles. There is a law that forbids tampering with or turning back the odometer mileage. This includes both the private citizen and the lot owner. The law also requires that the seller or anyone transferring ownership of the vehicle must provide the buyer with a signed statement indicating the mileage on the odometer at the time of transfer.

5. You may wish to contact the National Highway Traffic Safety Administration (NHTSA) to find out if the vehicle has ever been included in a manufacturer's recall. Write down the year, model and serial number before you buy the vehicle, then contact NHTSA (there should be a 1-800 number that your phone company's information line can supply). If the vehicle was listed for a recall, make sure the needed repairs were made.

6. Refer to the Used Vehicle Checklist in this section and check all the items on the vehicle you are considering. Some items are more important than others. Only you know how much money you can afford for repairs, and depending on the price of the vehicle, may consider performing any needed work yourself. Beware, however, of trouble in areas that will affect operation, safety or emission. Problems in the Used Vehicle Checklist break down as follows:

- Numbers 1-8: Two or more problems in these areas indicate a lack of maintenance. You should beware.
- Numbers 9-13: Problems here tend to indicate a lack of proper care, however, these can usually be corrected with a tune-up or relatively simple parts replacement.
- Numbers 14-17: Problems in the engine or transmission can be very expensive. Unless you are looking for a project, walk away from any vehicle with problems in 2 or more of these areas.

7. If you are satisfied with the apparent condition of the vehicle, take it to an independent diagnostic center or mechanic for a complete check. If you have a state inspection program, have it inspected immediately before purchase, or specify on the bill of sale that the sale is conditional on passing state inspection.

8. Road test the vehicle — refer to the Road Test Checklist in this section. If your original evaluation and the road test agree — the rest is up to you.

USED VEHICLE CHECKLIST

See Figure 265

➡The numbers on the illustrations refer to the numbers on this checklist.

1. Mileage: Average mileage is about 12,000-15,000 miles per year. More than average mileage may indicate hard usage or could indicate many highway miles (which could be less detrimental than half as many tough around town miles).

2. Paint: Check around the tailpipe, molding and windows for overspray indicating that the vehicle has been repainted.

3. Rust: Check fenders, doors, rocker panels, window moldings, wheelwells, floorboards, under floormats, and in the trunk for signs of rust. Any rust at all will be a problem. There is no way to permanently stop the spread of rust, except to replace the part or panel.

➡If rust repair is suspected, try using a magnet to check for body filler. A magnet should stick to the sheet metal parts of the body, but will not adhere to areas with large amounts of filler.

4. Body appearance: Check the moldings, bumpers, grille, vinyl roof, glass, doors, trunk lid and body panels for general overall condition. Check for misalignment, loose hold-down clips, ripples, scratches in glass, welding in the trunk, severe misalignment of body panels or ripples, any of which may indicate crash work.

5. Leaks: Get down and look under the vehicle. There are no normal leaks, other than water from the air conditioner condenser.

6. Tires: Check the tire air pressure. One old trick is to pump the tire pressure up to make the vehicle roll easier. Check the tread wear, open the trunk and check the spare too. Uneven wear is a clue that the front end may need an alignment.

7. Shock absorbers: Check the shock absorbers by forcing downward sharply on each corner of the vehicle. Good shocks will not allow the vehicle to bounce more than once after you let go.

8. Interior: Check the entire interior. You're looking for an interior condition that agrees with the overall condition of the vehicle. Reasonable wear is expected, but be suspicious of new seat covers on sagging seats, new pedal pads, and worn armrests. These indicate an attempt to cover up hard use. Pull back the carpets and look for evidence of water leaks or flooding. Look for missing hardware, door handles, control knobs, etc. Check lights and signal operations. Make sure all accessories (air conditioner, heater, radio, etc.) work. Check windshield wiper operation.

9. Belts and Hoses: Open the hood, then check all belts and hoses for wear, cracks or weak spots.

10. Battery: Low electrolyte level, corroded terminals and/or cracked case indicate a lack of maintenance.

11. Radiator: Look for corrosion or rust in the coolant indicating a lack of maintenance.

12. Air filter: A severely dirty air filter would indicate a lack of maintenance.

13. Ignition wires: Check the ignition wires for cracks, burned spots, or wear. Worn wires will have to be replaced.

14. Oil level: If the oil level is low, chances are the engine uses oil or leaks. Beware of water in the oil (there is probably a cracked block or bad head gasket), excessively thick oil (which is often used to quiet a noisy engine), or thin, dirty oil with a distinct gasoline smell (this may indicate internal engine problems).

15. Automatic Transmission: Pull the transmission dipstick out when the engine is running. The level should read FULL, and the fluid should be clear or bright red. Dark brown or black fluid that has distinct burnt odor, indicates a transmission in need of repair or overhaul.

16. Exhaust: Check the color of the exhaust smoke. Blue smoke indicates, among other problems, worn rings. Black smoke can indicate burnt valves or carburetor problems. Check the exhaust system for leaks; it can be expensive to replace.

17. Spark Plugs: Remove one or all of the spark plugs (the most accessible will do, though all are preferable). An engine in good condition will show plugs with a light tan or gray deposit on the firing tip.

ROAD TEST CHECKLIST

1. Engine Performance: The vehicle should be peppy whether cold or warm, with adequate power and good pickup. It should respond smoothly through the gears.

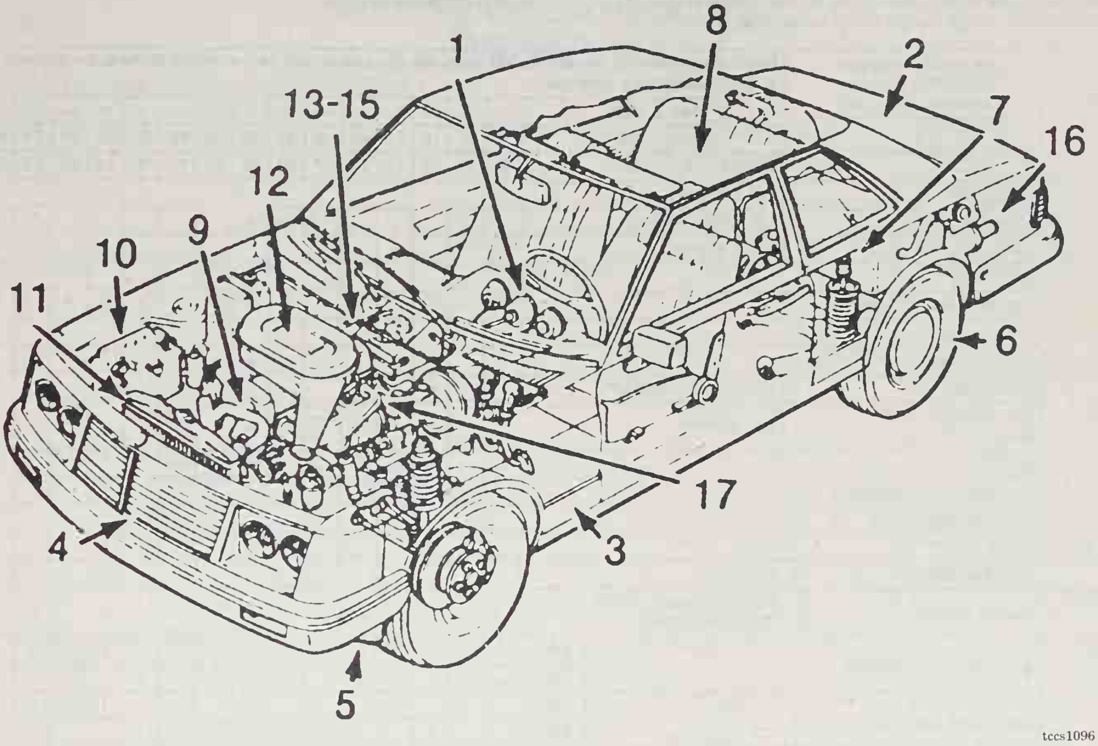

Fig. 265 Each of the numbered items should be checked when purchasing a used vehicle

2. Brakes: They should provide quick, firm stops with no noise, pulling or brake fade.

3. Steering: Sure control with no binding harshness, or looseness and no shimmy in the wheel should be expected. Noise or vibration from the steering wheel when turning the vehicle means trouble.

4. Clutch (Manual Transmission/Transaxle): Clutch action should give quick, smooth response with easy shifting. The clutch pedal should have free-play before it disengages the clutch. Start the engine, set the parking brake, put the transmission in first gear and slowly release the clutch pedal. The engine should begin to stall when the pedal is $\frac{1}{2}$-$\frac{3}{4}$ of the way up.

5. Automatic Transmission/Transaxle: The transmission should shift rapidly and smoothly, with no noise, hesitation, or slipping.

6. Differential: No noise or thumps should be present. Differentials have no normal leaks.

7. Driveshaft/Universal Joints: Vibration and noise could mean driveshaft problems. Clicking at low speed or coast conditions means worn U-joints.

8. Suspension: Try hitting bumps at different speeds. A vehicle that bounces excessively has weak shock absorbers or struts. Clunks mean worn bushings or ball joints.

9. Frame/Body: Wet the tires and drive in a straight line. Tracks should show two straight lines, not four. Four tire tracks indicate a frame/body bent by collision damage. If the tires can't be wet for this purpose, have a friend drive along behind you and see if the vehicle appears to be traveling in a straight line.

MAINTENANCE SCHEDULE A
1989-95 Truck

Maintenance operations: A = Check and adjust if necessary;
R = Replace, change or lubricate;
I = Inspect and correct or replace if necessary

- Towing a trailer, using a camper or car top carrier.
- Repeat short trips less than 5 miles (8 km) and outside temperatures remain below freezing.
- Extensive idling and/or low speed driving for a long distance such as police, taxi or door-to-door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

System	Service interval (Odometer reading or months, whichever comes first) Maintenance items		Maintenance services beyond 60,000 miles (96,000 km) should be performed at the same intervals shown in each maintenance schedule.															
		Miles × 1,000	5	7.5	10	15	20	22.5	25	30	35	37.5	40	45	50	52.5	55	60
		Km × 1,000	8	12	16	24	32	36	40	48	56	60	64	72	80	84	88	96
		Months	6	9	12	18	24	27	30	36	42	45	48	54	60	63	66	72
ENGINE	Timing belt	3VZ-E engine	R(1)															
	Valve clearance*	22R, 22R-E engine								A								A
	Valve clearance	3VZ-E engine																A
	Drive belts(2)									I								I
	Engine oil and oil filter*		R		R	R	R		R	R	R		R	R	R		R	R
	Engine coolant(3)																	R
	Exhaust pipes and mountings					I				I				I				
FUEL	Idle speed	22R-E, 3VZ-E engine(4)			A					A								A
	Idle speed and fast idle speed	22R engine(5)								A								
	Air filter* (9)		I		I	I	I		I	R	I		I	I	I		I	R
	Fuel lines and connections									I								I
	Fuel tank cap gasket																R	
IGNITION	Spark plugs**									R								R
EVAP	Charcoal canister	Calif. only																I
EXHAUST	Oxygen sensor*	Fed. and Canada 22R-E, 3VZ-E engine only	R(6)															
BRAKES	Brake linings and drums	4WD		I		I		I		I		I		I		I		I
		2WD			I		I			I			I		I			I
	Brake pads and discs	4WD		I		I		I		I		I		I		I		I
		2WD			I		I			I			I		I			I
	Brake line pipes and hoses	4WD				I				I				I				I
		2WD			I		I						I					I
CHASSIS	Steering linkage(10)	4WD		I		I		I		I		I		I		I		I
		2WD			I		I			I			I		I			I
	Ball joints and dust covers	4WD		I		I		I		I		I		I		I		I
		2WD			I		I			I			I		I			I
	Drive shaft boots	4WD		I		I		I		I		I		I		I		I
	Automatic transmission, manual transmission, transfer (4WD), differential and steering gear housing oil(7)	4WD				R				R				R				R
		2WD					R						R					R
	Front wheel bearing and thrust bush grease (4WD only)	4WD								R								R
		2WD											R					
	Propeller shaft grease(8)	4WD		R		R		R		R		R		R		R		R
	Bolts and nuts on chassis and body(9)	4WD		I		I		I		I		I		I		I		I
		2WD			I		I			I			I		I			I

* For vehicles sold in California

* For vehicles sold outside California

(1) For the vehicles frequently idled for extensive periods and/or driven for long distances at low speeds such as taxis, police cars and door-to-door delivery vehicles, it is recommended to replace at 60,000 miles (96,000 km).

(2) After 60,000 miles (96,000 km) or 72 months, inspect every 10,000 miles (16,000 km) or 12 months.

(3) After 60,000 miles (96,000 km) or 72 months, replace every 30,000 miles (48,000 km) or 36 months.

(4) After 60,000 miles (96,000 km) or 72 months, adjust every 30,000 miles (48,000 km) or 36 months.

(5) Adjustment at 30,000 miles (48,000 km) or 36 months only.

(6) Replace at 80,000 miles (129,000 km) only

(7) Inspect the steering gear housing for oil leakage only.

(8) If the propeller shaft has been immersed in water, it should be re-greased daily.

(9) Applicable when operating mainly on dusty roads. If not, follow the schedule B.

(10) Applicable when operating mainly on rough and/or muddy roads. If not, follow the schedule B.

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MAINTENANCE SCHEDULE B
1989-95 Truck

Conditions other than those listed for SCHEDULE A.

System	Service interval (Odometer reading or months, whichever comes first) / Maintenance items	Maintenance services beyond 60,000 miles (96,000 km) should be performed at the same intervals shown in each maintenance schedule.								
		Miles × 1,000	10	15	20	30	40	45	50	60
		Km × 1,000	16	24	32	48	64	72	80	96
		Months	12	18	24	36	48	54	60	72
ENGINE	Valve clearance*	22R, 22R-E engine				A				A
	Valve clearance	3VZ-E engine								A
	Drive belts(1)					I				I
	Engine oil and oil filter*		R		R	R	R		R	R
	Engine coolant(2)									R
	Exhaust pipes and mountings					I				I
FUEL	Idle speed	22R-E, 3VZ-E engine(3)	A			A				A
	Idle speed and fast idle speed	22R engine(4)				A				
	Air filter*					R				R
	Fuel lines and connections					I				I
	Fuel tank cap gasket									R
IGNITION	Spark plugs**					R				R
EVAP	Charcoal canister	Calif. only								I
EXHAUST	Oxygen sensor(5)*	Fed. and Canada 22R-E, 3VZ-E engine only	R (5)							
BRAKES	Brake linings and drums	4WD		I		I		I		I
		2WD			I		I			I
	Brake pads and discs	4WD		I		I		I		I
		2WD			I		I			I
	Brake line pipes and hoses	4WD		I		I		I		I
		2WD			I		I			I
CHASSIS	Steering linkage	4WD		I		I		I		I
		2WD			I		I			I
	Ball joints and dust covers	4WD		I		I		I		I
		2WD			I		I			I
	Drive shaft boots	4WD		I		I		I		I
	Automatic transmission, manual transmission, transfer (4WD), differential and steering gear housing oil(6)	4WD		I		I		I		I
		2WD			I		I			I
	Front wheel bearing and thrust bush grease (4WD only)	4WD				R				R
		2WD					R			
	Propeller shaft grease(7)	4WD		R		R		R		R
	Bolts and nuts on chassis and body(9)	4WD		I		I		I		I
		2WD			I		I			I

* For vehicles sold in California
* For vehicles sold outside California
(1) After 60,000 miles (96,000 km) or 72 months, inspect every 10,000 miles (16,000 km) or 12 months.
(2) After 60,000 miles (96,000 km) or 72 months, replace every 30,000 miles (48,000 km) or 36 months.
(3) After 60,000 miles (96,000 km) or 72 months, adjust every 30,000 miles (48,000 km) or 36 months.
(4) Adjustment at 30,000 miles (48,000 km) or 36 months only.
(5) Replace at 80,000 miles (129,000 km) only.
(6) Inspect the steering gear housing for oil leakage only.
(7) If the propeller shaft has been immersed in water, it should be re-greased daily.

86821322

MAINTENANCE SCHEDULE A
1989-90 Land Cruiser

Maintenance operations: A = Check and adjust if necessary;
R = Replace, change or lubricate;
I = Inspect and correct or replace if necessary

Conditions:
- Towing a trailer, using a camper or car top carrier.
- Repeated short trips of less than 5 miles (8 km) with outside temperatures remain below freezing.
- Extensive idling and/or low speed driving for long distances such as police, taxi or door-to-door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

System	Service interval (Odometer reading or months, whichever comes first) Maintenance items		Maintenance services beyond 60,000 miles (96,000 km) should continue to be performed at the same intervals shown in each maintenance schedule.																
		Miles × 1,000	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	Months
		km × 1,000	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
ENGINE	Valve clearance*					A				A				A				A	A: Every 24 months
	Drive belts(1)									I								I	I: 36 months; 72 months
	Engine oil and oil filter*		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R: Every 6 months
	Engine coolant(2)													R					R: 36 months
	Exhaust pipes and mountings					I				I				I				I	I: Every 24 months
FUEL	Air filter* (3)		I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	R	I: Every 6 months; R: Every 36 months
	Fuel lines and connections(4)									I								I	I: Every 36 months
	Fuel tank cap gasket																	R	R: Every 72 months
IGNITION	Spark plug**									R								R	R: Every 36 months
EVAP	Charcoal canister	Calif. only																I	I: Every 72 months
EXHAUST	Oxygen sensor*	Except California	R: 80,000 miles (128,000 km) only																
BRAKES	Brake linings and drums(5)			I		I		I		I		I		I		I		I	I: Every 12 months
	Brake pads and discs			I		I		I		I		I		I		I		I	I: Every 12 months
	Brake line pipes and hoses					I				I				I				I	I: Every 24 months
CHASSIS	Steering linkage			I		I		I		I		I		I		I		I	I: Every 12 months
	Ball joints and dust covers			I		I		I		I		I		I		I		I	I: Every 12 months
	Automatic transmission					R				R				R				R	I: Every 24 months
	Transfer, differential and steering gear box oil(6)					I				I				I				I	I: Every 24 months
	Front wheel bearing and thrust bush grease									R								R	R: Every 36 months
	Steering knuckle and chassis grease(7)			R		R		R		R		R		R		R		R	R: Every 12 months
	Propeller shaft grease(7)			R		R		R		R		R		R		R		R	R: Every 12 months
	Bolts and nuts on chassis and body(8)			I		I		I		I		I		I		I		I	I: Every 12 months

*: For vehicle sold in California
*: For vehicle sold outside California
(1) After 60,000 miles (96,000 km) or 72 months, inspect every 7,500 miles (12,000 km) or 12 months.
(2) After 45,000 miles (72,000 km) or 36 months, replace every 30,000 miles (48,000 km) or 24 months.
(3) Applicable when operating mainly on dusty roads. If not, follow schedule B.
(4) Includes inspection of fuel tank band and vapor vent system.
(5) Also applicable to lining drum for parking brake
(6) Inspect the steering gear box for oil leakage only
(7) If the propeller shaft has been immersed in water, it should be re-greased within a day.
(8) Applicable only when operating mainly on rough, muddy roads. The applicable parts are listed below. For other usage conditions, refer to SCHEDULE B
- Front and rear suspension member cross body
- Strut bar bracket cross body
- U bolts for leaf spring
- Bolts for sheet installation.

86821323

MAINTENANCE SCHEDULE B
1989-90 Land Cruiser

Maintenance operations: A = Check and adjust if necessary;
R = Replace, change or lubricate;
I = Inspect and correct or replace if necessary

Conditions: Conditions other than those listed for SCHEDULE A.

System	Service interval (Odometer reading or months, whichever comes first) / Maintenance items	Maintenance services beyond 60,000 miles (96,000 km) should be performed at the same intervals shown in each maintenance schedule.								
		Miles × 1,000	7.5	15	22.5	30	37.5	45	52.5	60	Months
		km × 1,000	12	24	36	48	60	72	84	96	
ENGINE	Valve clearance*			A		A		A		A	A: Every 24 months
	Drive belts(1)					I				I	I: 36 months, 72 months
	Engine oil and oil filter*		R	R	R	R	R	R	R	R	R: Every 12 months
	Engine coolant(2)							R			R: Every 36 months
	Exhaust pipes and mountings					I				I	I: Every 36 months
FUEL	Air filter*					R				R	R: Every 36 months
	Fuel lines and connections(3)					I				I	I: Every 36 months
	Fuel tank cap gasket									R	R: Every 72 months
IGNITION	Spark plug* *					R				R	R: Every 36 months
EVAP	Charcoal canister	California only								I	I: Every 72 months
EXHAUST	Oxygen sensor*	Except California	R: 80,000 miles (128,000 km) only								
BRAKES	Brake linings and drums(4)			I		I		I		I	I: Every 24 months
	Brake pads discs (Front and rear)			I		I		I		I	I: Every 24 months
	Brake line pipes and hoses			I		I		I		I	I: Every 24 months
CHASSIS	Steering linkage			I		I		I		I	I: Every 24 months
	Ball joints and dust covers			I		I		I		I	I: Every 24 months
	Front wheel bearing and thrust bush grease					R				R	R: Every 24 months
	Steering knuckle and chassis grease(5)			R		R		R		R	R: Every 24 months
	Propeller shaft grease(5)			R		R		R		R	R: Every 24 months
	Automatic transmission			I		I		I		I	I: Every 24 months
	Transfer, differential and steering gear box oil(6)			I		I		I		I	I: Every 24 months
	Bolts and nuts on chassis and body(7)			I		I		I		I	I: Every 24 months

*: For vehicle sold in California
*: For vehicle sold outside California
(1) After 60,000 miles (96,000 km) or 72 months, inspect every 7,500 miles (12,000 km) or 12 months.
(2) After 45,000 miles (72,000 km) or 36 months, replace every 30,000 miles (48,000 km) or 24 months.
(3) Includes inspection of fuel tank band vapor vent system.
(4) Also applicable to lining drum for parking brake.
(5) If the propeller shaft has been immersed in water, it should be re-greased within a day.
(6) Inspect the steering gear box for oil leakage only
(7) The applicable parts are listed below.
- Front and rear suspension member cross body
- Strut bar bracket cross body
- U bolts for leaf spring.
- Bolts for sheet installation.

86821324

MAINTENANCE SCHEDULE A
1991-92 Land Cruiser

Maintenance operations: A = Check and adjust if necessary;
R = Replace, change or lubricate;
I = Inspect and correct or replace if necessary

Conditions:

- Towing a trailer, using a camper or car top carrier.
- Repeat short trips less than 5 miles (8 km) and outside temperatures remain below freezing.
- Extensive idling and/or low speed driving for long distances, such as police, taxi or door-to-door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

System	Service interval (Odometer reading or months, whichever comes first) / Maintenance items	Maintenance services beyond 60,000 miles (96,000 km) should continue to be performed at the same intervals shown in each maintenance schedule.																	
		Miles × 1,000	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60[1]	Months
		km × 1,000	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
ENGINE	Valve clearance*					A				A				A				A	A: Every 24 months
	Drive belts(1)									I								I	I: 36 months; 72 months
	Engine oil and oil filter*		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R: Every 6 months
	Engine coolant(2)													R					R: 36 months
	Exhaust pipes and mountings					I				I				I				I	I: Every 24 months
FUEL	Air filter* (3)		I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	R	I: Every 6 months; R: Every 36 months
	Fuel lines and connections(4)									I								I	I: Every 36 months
	Fuel tank cap gasket																	R	R: Every 72 months
IGNITION	Spark plugs**									R								R	R: Every 36 months
EVAP	Charcoal canister	Calif. only																I	I: Every 72 months
EXHAUST	Oxygen sensor*	Except California	R: 80,000 miles (128,000 km) only																
BRAKES	Brake linings and drums(5)			I		I		I		I		I		I		I		I	I: Every 12 months
	Brake pads and discs			I		I		I		I		I		I		I		I	I: Every 12 months
	Brake line pipes and hoses					I				I				I				I	I: Every 24 months
CHASSIS	Steering linkage			I		I		I		I		I		I		I		I	I: Every 12 months
	Ball joints and dust covers			I		I		I		I		I		I		I		I	I: Every 12 months
	Automatic transmission					R				R				R				R	I: Every 24 months
	Transfer and differential					R				R				R				R	R: Every 24 months
	Steering gear box oil(6)					I				I				I				I	I: Every 24 months
	Front wheel bearing and thrust bush grease									R								R	R: Every 36 months
	Steering knuckle and chassis grease(7)			R		R		R		R		R		R		R		R	R: Every 12 months
	Propeller shaft grease(7)			R		R		R		R		R		R		R		R	R: Every 12 months
	Bolts and nuts on chassis and body(8)			I		I		I		I		I		I		I		I	I: Every 12 months

*: For vehicle sold in California
*: For vehicle sold outside California
(1) After 60,000 miles (96,000 km) or 72 months, inspect every 7,500 miles (12,000 km) or 12 months.
(2) After 45,000 miles (72,000 km) or 36 months, replace every 30,000 miles (48,000 km) or 24 months.
(3) Applicable when operating mainly on dusty roads. If not, follow schedule B.
(4) Includes inspection of fuel tank band and vapor vent system.
(5) Also applicable to lining drum for parking brake.
(6) Inspect the steering gear box for oil leakage only.
(7) If the propeller shaft has been immersed in water, it should be re-greased within a day.
(8) Applicable only when operating mainly on rough, muddy roads. The applicable parts are listed below. For other usage conditions, refer to SCHEDULE B.
- Bolts for sheet installation

86821325

MAINTENANCE SCHEDULE B
1991-92 Land Cruiser

Conditions: Conditions other than those listed for SCHEDULE A.

System	Service interval (Odometer reading or months, whichever comes first) Maintenance items		Maintenance services beyond 60,000 miles (96,000 km) should be performed at the same intervals shown in each maintenance schedule.								
		Miles × 1,000	7 5	15	22 5	30	37 5	45	52.5	60	Months
		km × 1,000	12	24	36	48	60	72	84	96	
ENGINE	Valve clearance*			A		A		A		A	A: Every 24 months
	Drive belts(1)					I				I	I: 36 months, 72 months
	Engine oil and oil filter*		R	R	R	R	R	R	R	R	R: Every 12 months
	Engine coolant(2)							R			R: Every 36 months
	Exhaust pipes and mountings					I				I	I: Every 36 months
FUEL	Air filter*					R				R	R: Every 36 months
	Fuel lines and connections(3)					I				I	I: Every 36 months
	Fuel tank cap gasket									R	R: Every 72 months
IGNITION	Spark plugs**					R				R	R: Every 36 months
EVAP	Charcoal canister	California only								I	I: Every 72 months
EXHAUST	Oxygen sensor*	Except California	R: 80,000 miles (129,000 km) only								
BRAKES	Brake linings and drums(4)			I		I		I		I	I: Every 24 months
	Brake pads discs (Front and rear)			I		I		I		I	I: Every 24 months
	Brake line pipes and hoses			I		I		I		I	I: Every 24 months
CHASSIS	Steering linkage			I		I		I		I	I: Every 24 months
	Ball joints and dust covers			I		I		I		I	I: Every 24 months
	Front wheel bearing and thrust bush grease					R				R	R: Every 24 months
	Steering knuckle and chassis grease(5)			R		R		R		R	R: Every 24 months
	Propeller shaft grease(5)			R		R		R		R	R: Every 24 months
	Automatic transmission			I		I		I		I	I: Every 24 months
	Transfer, differential and steering gear box oil(6)			I		I		I		I	I: Every 24 months
	Bolts and nuts on chassis and body(7)			I		I		I		I	I: Every 24 months

*: For vehicle sold in California
*: For vehicle sold outside California
(1) After 60,000 miles (96,000 km) or 72 months, inspect every 7,500 miles (12,000 km) or 12 months.
(2) After 45,000 miles (72,000 km) or 36 months, replace every 30,000 miles (48,000 km) or 24 months.
(3) Includes inspection of fuel tank band vapor vent system.
(4) Also applicable to lining drum for parking brake
(5) If the propeller shaft has been immersed in water, it should be re-greased within a day.
(6) Inspect the steering gear box for oil leakage only.

86821326

SCHEDULE A 1993-96 LAND CRUISER

Maintenance operations:
A = Check and adjust as necessary; I = Inspect and correct or replace as necessary; R = Replace, change or lubricate.

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	
	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	

ENGINE COMPONENTS AND EMISSION CONTROL SYSTEMS

Engine oil and oil filter*	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R:Every 6 months
Valve clearance																A	A:Every 72 months
Drive belts «See note 1.»	Inspect at 48000 km (30000 miles) or 36 months and at 96000 km (60000 miles) or 72 months.																
Engine coolant «See note 2.»	Initial change at first 72000 km (45000 miles) or 36 months.																
Exhaust pipes and mountings				I				I				I				I	I:Every 24 months
Air cleaner filter* «See note 3.»	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	R	I:Every 6 months R:Every 36 months

Maintenance operations:

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	
	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
Fuel lines and connections, fuel tank vapor vent system hoses and fuel tank band									I								I	I:Every 36 months
Fuel tank cap gasket																	R	R:Every 72 months
Spark plugs**									R								R	R:Every 36 months
Charcoal canister (California and New York only)																	I	I:Every 72 months
Oxygen sensor (except California and New York)		Replace at initial 128000 km (80000 miles).																

CHASSIS AND BODY

Brake linings and drums		I		I		I		I		I		I		I		I	I:Every 12 months
Brake pads and discs		I		I		I		I		I		I		I		I	I:Every 12 months
Brake lines and hoses				I				I				I				I	I:Every 24 months
Steering linkage		I		I		I		I		I		I		I		I	I:Every 12 months
Ball joints and dust covers		I		I		I		I		I		I		I		I	I:Every 12 months
Automatic transmission				R				R				R				R	R:Every 24 months
Transfer and differential				R				R				R				R	R:Every 24 months
Steering gear box				I				I				I				I	I:Every 24 months

Maintenance operations:

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	
	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
Wheel bearing and drive shaft bushing grease									R								R	R:Every 36 months
Steering knuckle grease			R		R		R		R		R		R		R		R	R:Every 12 months
Propeller shaft grease			R		R		R		R		R		R		R		R	R:Every 12 months
Bolts and nuts on chassis and body «See note 4»			I		I		I		I		I		I		I		I	I:Every 12 months

Maintenance services indicated by * or * are required under the terms of the Emission Control Systems Warranty. See Owner's Guide or Warranty Booklet for complete warranty information.
* : For vehicles sold in California and New York only
* : For vehicles sold outside California and New York

NOTE:
1. After 96000 km (60000 miles) or 72 months, inspect every 12000 km (7500 miles) or 12 months.
2. After 72000 km (45000 miles) or 36 months, change every 48000 km (30000 miles) or 24 months.
3. Applicable when you mainly operate your vehicle on dusty roads. If not, apply Schedule B.
4. Applicable when you mainly operate your vehicle on rough and/or muddy roads. If not, apply Schedule B.

86821327

SCHEDULE B 1993-96 LAND CRUISER

Maintenance operations:
A = Check and adjust as necessary; **I** = Inspect and correct or replace as necessary; **R** = Replace, change or lubricate.

SERVICE INTERVAL:		Odometer reading								Months
(Use odometer reading or months, whichever comes first.)	x 1000 miles	7.5	15	22.5	30	37.5	45	52.5	60	
	x 1000 km	12	24	36	48	60	72	84	96	

ENGINE COMPONENTS AND EMISSION CONTROL SYSTEMS

Engine oil and oil filter*	R	R	R	R	R	R	R	R	R: Every 12 months
Valve clearance								A	A: Every 72 months
Drive belts «See note 1.»	Inspect at 48000 km (30000 miles) or 36 months and at 96000 km (60000 miles) or 72 months.								
Engine coolant «See note 2.»	Initial change at first 72000 km (45000 miles) or 36 months.								
Exhaust pipes and mountings				I				I	I: Every 36 months
Air cleaner filter*				R				R	R: Every 36 months
Fuel lines and connections, fuel tank vapor vent system hoses and fuel tank band				I				I	I: Every 36 months
Fuel tank cap gasket								R	R: Every 72 months
Spark plugs**				R				R	R: Every 36 months

Maintenance operations:

SERVICE INTERVAL:		Odometer reading								Months
(Use odometer reading or months, whichever comes first.)	x 1000 miles	7.5	15	22.5	30	37.5	45	52.5	60	
	x 1000 km	12	24	36	48	60	72	84	96	
Charcoal canister (California and New York only)									I	I: Every 72 months
Oxygen sensor (except California and New York)		Replace at initial 128000 km (80000 miles).								

CHASSIS AND BODY

Brake linings and drums		I		I		I		I	I: Every 24 months
Brake pads and discs		I		I		I		I	I: Every 24 months
Brake lines and hoses		I		I		I		I	I: Every 24 months
Steering linkage		I		I		I		I	I: Every 24 months
Ball joints and dust covers		I		I		I		I	I: Every 24 months
Automatic transmission		I		I		I		I	I: Every 24 months
Transfer and differential		I		I		I		I	I: Every 24 months
Steering gear box		I		I		I		I	I: Every 24 months
Wheel bearing and drive shaft bushing grease				R				R	R: Every 36 months
Steering knuckle grease		R		R		R		R	R: Every 24 months
Propeller shaft grease		R		R		R		R	R: Every 24 months
Bolts and nuts on chassis and body		I		I		I		I	I: Every 24 months

Maintenance services indicated by * or * are required under the terms of the Emission Control Systems Warranty. See Owner's Guide or Warranty Booklet for complete warranty information.
* : For vehicles sold in California and New York only
* : For vehicles sold outside California and New York

NOTE:
1. After 96000 km (60000 miles) or 72 months, inspect every 12000 km (7500 miles) or 12 months.
2. After 72000 km (45000 miles) or 36 months, change every 48000 km (30000 miles) or 24 months.

86821328

SCHEDULE A 1996 TRUCK

Maintenance operations:

A = Check and adjust as necessary; **I** = Inspect and correct or replace as necessary; **R** = Replace, change or lubricate.

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	

ENGINE COMPONENTS AND EMISSION CONTROL SYSTEMS

Engine oil and oil filter*		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R:Every 6 months
Timing belt (5VZ-FE engine)		If you operate your vehicle under conditions of extensive idling and/or low speed driving for a long distance such as police, taxi or door-to-door delivery use, replace every 96000 km (60000 miles).																
Valve clearance																	A	A:Every 72 months
Drive belts «See note 1.»		Inspect at 96000 km (60000 miles) or 72 months.																
Engine coolant «See note 2.»		Initial change at first 72000 km (45000 miles) or 36 months.																
Exhaust pipes and mountings					I				I				I				I	I:Every 24 months
Air cleaner filter* «See note 3.»		I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	R	I:Every 6 months R:Every 36 months

Maintenance operations:

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	
Fuel lines and connections, fuel tank vapor vent system hoses and fuel tank band									I								I	I:Every 36 months
Fuel tank cap gasket																	R	R:Every 72 months
Spark plugs**									R								R	R:Every 36 months
Charcoal canister «See note 4.»																	I	I:Every 72 months

CHASSIS AND BODY

Brake linings and drums			I		I		I		I		I		I		I		I	I:Every 12 months
Brake pads and discs			I		I		I		I		I		I		I		I	I:Every 12 months
Brake lines and hoses					I				I				I				I	I:Every 24 months
Steering linkage			I		I		I		I		I		I		I		I	I:Every 12 months
SRS airbag «See note 5.»		Initial inspect at first 120 months.																
Ball joints and dust covers			I		I		I		I		I		I		I		I	I:Every 12 months

Maintenance operations:

SERVICE INTERVAL:		Odometer reading																Months
(Use odometer reading or months, whichever comes first.)	x 1000 km	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
	x 1000 miles	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60	
Drive shaft boots (four-wheel drive models)			I		I		I		I		I		I		I		I	I:Every 12 months
Automatic transmission, manual transmission and differential					R				R				R				R	R:Every 24 months
Transfer (four-wheel drive models)					R				R				R				R	R:Every 24 months
Steering gear box					I				I				I				I	I:Every 24 months
Wheel bearing grease (two-wheel drive models)									R								R	R:Every 48 months
Wheel bearing and drive shaft bushing grease (four-wheel drive models)									R								R	R:Every 36 months
Propeller shaft grease (four-wheel drive models)			R		R		R		R		R		R		R		R	R:Every 12 months
Bolts and nuts on chassis and body «See note 6.»			I		I		I		I		I		I		I		I	I:Every 12 months

Maintenance services indicated by * or ** are required under the terms of the Emission Control Systems Warranty. See Owner's Guide or Warranty Booklet for complete warranty information.

* : For vehicles sold in California, Massachusetts and New York only

** : For vehicles sold outside California, Massachusetts and New York

NOTE:

1. After 96000 km (60000 miles) or 72 months, inspect every 12000 km (7500 miles) or 12 months.
2. After 72000 km (45000 miles) or 36 months, change every 48000 km (30000 miles) or 24 months.
3. Applicable when you mainly operate your vehicle on dusty roads. If not, apply Schedule B.
4. Non-maintenance item except for California, Massachusetts and New York.
5. After 120 months, inspect every 24 months.
6. Applicable when you mainly operate your vehicle on rough and/or muddy roads. If not, apply Schedule B.

86821330

SCHEDULE B 1996 TRUCK

Maintenance operations:
A = Check and adjust as necessary; **I** = Inspect and correct or replace as necessary; **R** = Replace, change or lubricate.

SERVICE INTERVAL: (Use odometer reading or months, whichever comes first.)		Odometer reading								Months
	x 1000 km	12	24	36	48	60	72	84	96	
	x 1000 miles	7.5	15	22.5	30	37.5	45	52.5	60	

ENGINE COMPONENTS AND EMISSION CONTROL SYSTEMS

Engine oil and oil filter*		R	R	R	R	R	R	R	R	R: Every 12 months
Valve clearance									A	A: Every 72 months
Drive belts «See note 1.»		Inspect at 96000 km (60000 miles) or 72 months.								
Engine coolant «See note 2.»		Initial change at first 72000 km (45000 miles) or 36 months.								
Exhaust pipes and mountings					I				I	I: Every 36 months
Air cleaner filter*					R				R	R: Every 36 months
Fuel lines and connections, fuel tank vapor vent system hoses and fuel tank band					I				I	I: Every 36 months
Fuel tank cap gasket									R	R: Every 72 months
Spark plugs* *					R				R	R: Every 36 months
Charcoal canister «See note 3.»									I	I: Every 72 months

Maintanance operations:

SERVICE INTERVAL: (Use odometer reading or months, whichever comes first.)		Odometer reading								Months
	x 1000 km	12	24	36	48	60	72	84	96	
	x 1000 miles	7.5	15	22.5	30	37.5	45	52.5	60	

CHASSIS AND BODY

Brake linings and drums			I		I		I		I	I: Every 24 months
Brake pads and discs			I		I		I		I	I: Every 24 months
Brake lines and hoses			I		I		I		I	I: Every 24 months
Steering linkage			I		I		I		I	I: Every 24 months
SRS airbag «See note 4.»		Initial inspect at first 120 months.								
Ball joints and dust covers			I		I		I		I	I: Every 24 months
Drive shaft boots (four-wheel drive models)			I		I		I		I	I: Every 24 months
Automatic transmission, manual transmission and differential			I		I		I		I	I: Every 24 months
Transfer (four-wheel drive models)			I		I		I		I	I: Every 24 months
Steering gear box			I		I		I		I	I: Every 24 months
Wheel bearing grease (two-wheel drive models)					R				R	R: Every 48 months

Maintenanca oparations:

SERVICE INTERVAL: (Use odometer reading or months, whichever comes first.)		Odometer reading								Months
	x 1000 km	12	24	36	48	60	72	84	96	
	x 1000 miles	7.5	15	22.5	30	37.5	45	52.5	60	
Wheel bearing and drive shaft bushing grease (four-wheel drive models)					R				R	R: Every 36 months
Propeller shaft grease (four-wheel drive models)			R		R		R		R	R: Every 24 months
Bolts and nuts on chassis and body			I		I		I		I	I: Every 24 months

Maintenance services indicated by * or * are required under the terms of the Emission Control Systems Warranty. See Owner's Guide or Warranty Booklet for complete warranty information.
* : For vehicles sold in California, Massachusetts and New York only
* : For vehicles sold outside California, Massachusetts and New York

NOTE:
1. After 96000 km (60000 miles) or 72 months, inspect every 12000 km (7500 miles) or 12 months.
2. After 72000 km (45000 miles) or 36 months, change every 48000 km (30000 miles) or 24 months.
3. Non-maintenance item except for California and New York.
4. After 120 months, inspect every 24 months.

86821329

CAPACITIES

Year	Model	Engine ID/VIN	Engine Displacement Liters (cc)	Engine Oil with Filter (qts.)	Transmission (pts.)			Transfer Case (pts.)	Drive Axle		Fuel Tank (gal.)	Cooling System (qts.)
					4-Spd	5-Spd	Auto.		Front (pts.)	Rear (pts.)		
1989	Pick-up	22R	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	Pick-up	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑤	②
	4Runner	22R	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	4Runner	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑤	②
	Land Cruiser	3F-E	4.0 (3956)	8.2	-	-	12.6	4.4	6.0	6.8	25.1	③
1990	Pick-up	22R	2.4 (2366)	4.5	-	⑬	⑥	⑧	⑨	④	⑤	①
	Pick-up	22R-E	2.4 (2366)	4.5	-	⑬	⑥	⑧	⑨	④	⑤	①
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑬	⑥	⑧	⑨	④	⑤	②
	4Runner	22R-E	2.4 (2366)	4.5	-	⑬	⑥	⑧	⑨	④	⑤	①
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑬	⑥	⑧	⑨	④	⑤	②
	Land Cruiser	3F-E	4.0 (3956)	8.2	-	-	12.6	4.4	6	6.8	25.1	③
1991	Pick-up	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑪	①
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑪	②
	4Runner	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑤	②
	Land Cruiser	3F-E	4.0 (3956)	8.2	-		12.6	4.0	6.0	6.8	25.1	③
1992	Pick-up	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑪	①
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑪	②
	4Runner	22R-E	2.4 (2366)	4.5	-	⑬	⑦	⑧	⑨	④	⑤	①
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑬	⑦	⑧	⑨	④	⑤	②
	Land Cruiser	3F-E	4.0 (3956)	8.2	-	-	12.6	4.4	6.0	6.8	25.1	③
1993	Pick-up	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	⑩
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑫
	4Runner	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	⑩
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑫
	T100	3VZ-E	3.0 (2959)	4.8	-	6.4	⑦	2.4	⑨	⑳	⑮	⑫
	Land Cruiser	1FZ-FE	4.5 (4477)	7.8	-	-	12.6	㉙	⑭	6.8	25.1	15.0
1994	Pick-up	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	①
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑫
	4Runner	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	⑩
	4Runner	3VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑫
	T100	3RZ-FE	2.7 (2693)	5.6	-	2.7	-	-	-	3.8	19.8	9.2
	T100	3VZ-E	3.0 (2959)	4.8	-	6.4	⑦	2.4	⑨	⑳	⑮	⑫
	Land Cruiser	1FZ-FE	4.5 (4477)	7.8	-	-	12.6	㉙	⑭	6.8	25.1	15.0

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CAPACITIES

Year	Model	Engine ID/VIN	Engine Displacement Liters (cc)	Engine Oil with Filter (qts.)	Transmission (pts.) 4-Spd	Transmission (pts.) 5-Spd	Transmission (pts.) Auto.	Transfer Case (pts.)	Drive Axle Front (pts.)	Drive Axle Rear (pts.)	Fuel Tank (gal.)	Cooling System (qts.)
1995	Pick-up	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	⑩
	Pick-up	3VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑲
	4Runner	22R-E	2.4 (2366)	4.5	-	⑰	⑦	⑱	⑨	⑳	⑮	-
	4Runner	2VZ-E	3.0 (2959)	4.8	-	⑰	⑦	⑱	⑨	⑳	⑮	⑲
	Tacoma	2RZ-FE	2.4 (2438)	5.8	-	㉓	㉔	2.2	㉕	2.9	15.1	㉖
	Tacoma	3RZ-FE	2.7 (2693)	5.8	-	㉓	㉔	2.2	㉕	㉗	18.0	㉖
	Tacoma	5VZ-FE	3.4 (3378)	⑯	-	㉓	㉔	2.2	㉕	㉗	18.0	㉖
	T100	3RZ-FE	2.7 (2693)	5.6	-	2.7	-	-	-	3.8	19.8	9.2
	T100	5VZ-FE	3.4 (3378)	㉘	㉑	⑦	2.4	3.9	㉒	-	24.0	⑲
	Land Cruiser	1FZ-FE	4.5 (4477)	7.8	-	-	12.6	㉙	⑭	6.8	25.1	15.0
1996	Tacoma	2RZ-FE	2.4 (2438)	5.8	-	㉓	㉔	2.2	㉕	2.9	15.1	㉖
	Tacoma	3RZ-FE	2.7 (2693)	5.8	-	㉓	㉔	2.2	㉕	㉗	18.0	㉖
	Tacoma	5VZ-FE	3.4 (3378)	⑯	-	㉓	㉔	2.2	㉕	㉗	18.0	㉖
	T100	3RZ-FE	2.7 (2693)	5.6	-	2.7	-	-	-	3.8	19.8	9.2
	T100	5VZ-FE	3.4 (3378)	㉘	㉑	⑦	2.4	3.9	㉒	-	24.0	⑲
	Land Cruiser	1FZ-FE	4.5 (4477)	7.8	-	-	12.6	㉙	⑭	6.8	25.1	15.0

1 Except 4WD automatic transmission: 8.9
4WD automatic transmission: 9.6
2 Manual transmission: 11.1
Automatic transmission: 10.9
3 With rear heater: 20.6
Without rear heater: 18.5
4 2WD 7.5" differential: 2.8
2WD 8.0" differential: 3.8
4WD: 4.6
5 Standard: 17.2; Optional: 19.3
6 With oil cooler: 4.4
Without oil cooler: 4.3
7 2WD with A340E: 3.4
4WD with A340H: 9.6
4WD with A340F: 4.2
8 Counter gear type: 2.4
Planetary gear type: 2.4
A340H: 1.8
9 Standard: 3.4; ADD: 4.0
10 With rear heater: 9.2
Without rear heater: 8.9
11 Short bed: 13.7
Long bed: 17.2
Long bed 4WD: 19.3
12 2WD manual transmission: 11.0
2WD automatic tranmission: 10.8
4WD manual transmission: 11.1
4WD automatic transmission: 10.9
13 2WD with W56: 5.0
4WD: with W56: 6.4
4WD with G58: 8.2
4WD: with R150F: 6.4
14 With differential lock: 5.6
Without differential lock: 5.8
15 With standard tires: 17.2
With optional 31x10.5 tires: 18.8
16 2WD: 5.7
4WD: 5.5
17 G58: 8.2
R150F: 6.4
18 Except 3VZ-E AT (VF1A type): 2.4
3VZ-E AT (A340H): 1.6
19 2WD with manual transmission: 10.6
2WD with automatic transmission: 10.5
4WD with manual transmission: 10.6
4WD with automatic transmission: 10.8
20 2WD: 3.8; 4WD: 4.6
21 2WD: 5.4
4WD: 4.6
22 2WD: 4.4
4WD: 4.3
23 W59.
2WD: 5.4
4WD: 5.2
R150, R150F:
2WD: 5.4
4WD: 4.6
24 A43D: 5.0
A340E: 3.4
A340F: 4.2
25 Without ADD: 2.32
With ADD: 2.44
26 2WD with manual transmission: 8.5
2WD with automatic transmission: 8.2
4WD with manual transmission: 8.8
4WD with automatic transmission: 8.7
27 Extra long. 4.4
All others: 5.4
28 2WD: 5.5
4WD: 5.0
29 With ABS: 2.8
Without ABS: 3.6

86821332

GASOLINE ENGINE TUNE-UP

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Spark Plugs Gap (in.)	Ignition Timing (deg.)		Fuel Pump (psi)	Idle Speed (rpm)		Valve Clearance	
				MT	AT		MT	AT	In.	Ex.
1989	22R	2.4 (2366)	0.031	-	-	2.1-4.3	700	750	0.008	0.012
	22R-E	2.4 (2366)	0.031	5B ①	5B	35-38	750	750	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	0.012	0.013
	3F-E	4.0 (3956)	0.031	7B	7B	37-46	650	650	0.008	0.014
1990	22R	2.4 (2366)	0.031	-	-	2.1-4.3	750	850	0.008	0.012
	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	0.007-0.011	0.009-0.013
	3F-E	4.0 (3956)	0.031	-	7B	37-46	650	650	0.008	0.014
1991	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	②	③
	3F-E	4.0 (3956)	0.031	-	7B	37-46	650	650	0.008	0.014
1992	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	②	③
	3F-E	4.0 (3956)	0.031	-	7B	37-46	650	650	0.008	0.014
1993	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	3VZ-E	3.0 (2959)	0.041	10B	10B	38-44	800	800	②	③
	1FZ-FE	4.5 (4477)	0.031	-	3B	38-44	-	600-700	0.006-0.010	0.010-0.014
1994	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	3RZ-FE	2.7 (2693)	0.031	5B	-	38-44	750	-	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	②	③
	1FZ-FE	4.5 (4477)	0.031	-	3B	38-44	-	600-700	0.006-0.010	0.010-0.014
1995	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	2RZ-FE	2.4 (2438)	0.031	⑤	⑤	38-44	650-750	650-750	0.006-0.010	0.010-0.014

86821210

GASOLINE ENGINE TUNE-UP

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Spark Plugs Gap (In.)	Ignition Timing (deg.)		Fuel Pump (psi)	Idle Speed (rpm)		Valve Clearance	
				MT	AT		MT	AT	In.	Ex.
1995	3RZ-FE	2.7 (2693)	0.031	⑤	⑤	38-44	750	-	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	②	③
	5VZ-FE	3.4 (3378)	0.043	④	④	38-44	650-750	650-750	0.006-0.009	0.011-0.014
	1FZ-FE	4.5 (4477)	0.031	-	3B	38-44	-	600-700	0.006-0.010	0.010-0.014
1996	22R-E	2.4 (2366)	0.031	5B	5B	38-44	750	850	0.008	0.012
	2RZ-FE	2.4 (2438)	0.031	⑤	⑤	38-44	650-750	650-750	0.006-0.010	0.010-0.014
	3RZ-FE	2.7 (2693)	0.031	⑤	⑤	38-44	750	-	0.008	0.012
	3VZ-E	3.0 (2959)	0.031	10B	10B	38-44	800	800	②	③
	5VZ-FE	3.4 (3378)	0.043	④	④	38-44	650-750	650-750	0.006-0.009	0.011-0.014
	1FZ-FE	4.5 (4477)	0.031	-	3B	38-44	-	600-700	0.006-0.010	0.010-0.014

NOTE: The Vehicle Emission Control Information label often reflects specification changes made during production. The label figures must be used if they differ from those in this chart.

B - Before top dead center

1 T terminal shorted

2 Intake: 0.007-0.011 (cold)

3 Exhaust: 0.009-0.013 (cold)

4 10B at idle, with terminal TE1 and E1 connected of DLC1

5 5B at idle, with terminal TE1 and E1 connected of DLC1

86821ppp

ENGLISH TO METRIC CONVERSION: MASS (WEIGHT)

Current mass measurement is expressed in pounds and ounces (lbs. & ozs.). The metric unit of mass (or weight) is the kilogram (kg). Even although this table does not show conversion of masses (weights) larger than 15 lbs, it is easy to calculate larger units by following the data immediately below.

To convert ounces (oz.) to grams (g): multiply th number of ozs. by 28
To convert grams (g) to ounces (oz.): multiply the number of grams by .035

To convert pounds (lbs.) to kilograms (kg): multiply the number of lbs. by .45
To convert kilograms (kg) to pounds (lbs.): multiply the number of kilograms by 2.2

lbs	kg	lbs	kg	oz	kg	oz	kg
0.1	0.04	0.9	0.41	0.1	0.003	0.9	0.024
0.2	0.09	1	0.4	0.2	0.005	1	0.03
0.3	0.14	2	0.9	0.3	0.008	2	0.06
0.4	0.18	3	1.4	0.4	0.011	3	0.08
0.5	0.23	4	1.8	0.5	0.014	4	0.11
0.6	0.27	5	2.3	0.6	0.017	5	0.14
0.7	0.32	10	4.5	0.7	0.020	10	0.28
0.8	0.36	15	6.8	0.8	0.023	15	0.42

ENGLISH TO METRIC CONVERSION: TEMPERATURE

To convert Fahrenheit (°F) to Celsius (°C): take number of °F and subtract 32; multiply result by 5; divide result by 9

To convert Celsius (°C) to Fahrenheit (°F): take number of °C and multiply by 9; divide result by 5; add 32 to total

Fahrenheit (F)	Celsius (C)			Fahrenheit (F)	Celsius (C)			Fahrenheit (F)	Celsius (C)		
°F	°C	°C	°F	°F	°C	°C	°F	°F	°C	°C	°F
−40	−40	−38	−36.4	80	26.7	18	64.4	215	101.7	80	176
−35	−37.2	−36	−32.8	85	29.4	20	68	220	104.4	85	185
−30	−34.4	−34	−29.2	90	32.2	22	71.6	225	107.2	90	194
−25	−31.7	−32	−25.6	95	35.0	24	75.2	230	110.0	95	202
−20	−28.9	−30	−22	100	37.8	26	78.8	235	112.8	100	212
−15	−26.1	−28	−18.4	105	40.6	28	82.4	240	115.6	105	221
−10	−23.3	−26	−14.8	110	43.3	30	86	245	118.3	110	230
−5	−20.6	−24	−11.2	115	46.1	32	89.6	250	121.1	115	239
0	−17.8	−22	−7.6	120	48.9	34	93.2	255	123.9	120	248
1	−17.2	−20	−4	125	51.7	36	96.8	260	126.6	125	257
2	−16.7	−18	−0.4	130	54.4	38	100.4	265	129.4	130	266
3	−16.1	−16	3.2	135	57.2	40	104	270	132.2	135	275
4	−15.6	−14	6.8	140	60.0	42	107.6	275	135.0	140	284
5	−15.0	−12	10.4	145	62.8	44	112.2	280	137.8	145	293
10	−12.2	−10	14	150	65.6	46	114.8	285	140.6	150	302
15	−9.4	−8	17.6	155	68.3	48	118.4	290	143.3	155	311
20	−6.7	−6	21.2	160	71.1	50	122	295	146.1	160	320
25	−3.9	−4	24.8	165	73.9	52	125.6	300	148.9	165	329
30	−1.1	−2	28.4	170	76.7	54	129.2	305	151.7	170	338
35	1.7	0	32	175	79.4	56	132.8	310	154.4	175	347
40	4.4	2	35.6	180	82.2	58	136.4	315	157.2	180	356
45	7.2	4	39.2	185	85.0	60	140	320	160.0	185	365
50	10.0	6	42.8	190	87.8	62	143.6	325	162.8	190	374
55	12.8	8	46.4	195	90.6	64	147.2	330	165.6	195	383
60	15.6	10	50	200	93.3	66	150.8	335	168.3	200	392
65	18.3	12	53.6	205	96.1	68	154.4	340	171.1	205	401
70	21.1	14	57.2	210	98.9	70	158	345	173.9	210	410
75	23.9	16	60.8	212	100.0	75	167	350	176.7	215	414

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ENGLISH TO METRIC CONVERSION: LENGTH

To convert inches (ins.) to millimeters (mm): multiply number of inches by 25.4

To convert millimeters (mm) to inches (ins.): multiply number of millimeters by .04

Inches	Decimals	Milli-meters	Inches to millimeters		Inches	Decimals	Milli-meters	Inches to millimeters	
			inches	mm				inches	mm
1/64	0.051625	0.3969	0.0001	0.00254	33/64	0.515625	13.0969	0.6	15.24
1/32	0.03125	0.7937	0.0002	0.00508	17/32	0.53125	13.4937	0.7	17.78
3/64	0.046875	1.1906	0.0003	0.00762	35/64	0.546875	13.8906	0.8	20.32
1/16	0.0625	1.5875	0.0004	0.01016	9/16	0.5625	14.2875	0.9	22.86
5/64	0.078125	1.9844	0.0005	0.01270	37/64	0.578125	14.6844	1	25.4
3/32	0.09375	2.3812	0.0006	0.01524	19/32	0.59375	15.0812	2	50.8
7/64	0.109375	2.7781	0.0007	0.01778	39/64	0.609375	15.4781	3	76.2
1/8	0.125	3.1750	0.0008	0.02032	5/8	0.625	15.8750	4	101.6
9/64	0.140625	3.5719	0.0009	0.02286	41/64	0.640625	16.2719	5	127.0
5/32	0.15625	3.9687	0.001	0.0254	21/32	0.65625	16.6687	6	152.4
11/64	0.171875	4.3656	0.002	0.0508	43/64	0.671875	17.0656	7	177.8
3/16	0.1875	4.7625	0.003	0.0762	11/16	0.6875	17.4625	8	203.2
13/64	0.203125	5.1594	0.004	0.1016	45/64	0.703125	17.8594	9	228.6
7/32	0.21875	5.5562	0.005	0.1270	23/32	0.71875	18.2562	10	254.0
15/64	0.234375	5.9531	0.006	0.1524	47/64	0.734375	18.6531	11	279.4
1/4	0.25	6.3500	0.007	0.1778	3/4	0.75	19.0500	12	304.8
17/64	0.265625	6.7469	0.008	0.2032	49/64	0.765625	19.4469	13	330.2
9/32	0.28125	7.1437	0.009	0.2286	25/32	0.78125	19.8437	14	355.6
19/64	0.296875	7.5406	0.01	0.254	51/64	0.796875	20.2406	15	381.0
5/16	0.3125	7.9375	0.02	0.508	13/16	0.8125	20.6375	16	406.4
21/64	0.328125	8.3344	0.03	0.762	53/64	0.828125	21.0344	17	431.8
11/32	0.34375	8.7312	0.04	1.016	27/32	0.84375	21.4312	18	457.2
23/64	0.359375	9.1281	0.05	1.270	55/64	0.859375	21.8281	19	482.6
3/8	0.375	9.5250	0.06	1.524	7/8	0.875	22.2250	20	508.0
25/64	0.390625	9.9219	0.07	1.778	57/64	0.890625	22.6219	21	533.4
13/32	0.40625	10.3187	0.08	2.032	29/32	0.90625	23.0187	22	558.8
27/64	0.421875	10.7156	0.09	2.286	59/64	0.921875	23.4156	23	584.2
7/16	0.4375	11.1125	0.1	2.54	15/16	0.9375	23.8125	24	609.6
29/64	0.453125	11.5094	0.2	5.08	61/64	0.953125	24.2094	25	635.0
15/32	0.46875	11.9062	0.3	7.62	31/32	0.96875	24.6062	26	660.4
31/64	0.484375	12.3031	0.4	10.16	63/64	0.984375	25.0031	27	690.6
1/2	0.5	12.7000	0.5	12.70					

ENGLISH TO METRIC CONVERSION: TORQUE

To convert foot-pounds (ft. lbs.) to Newton-meters: multiply the number of ft. lbs. by 1.3

To convert inch-pounds (in. lbs.) to Newton-meters: multiply the number of in. lbs. by .11

in lbs	N·m	in lbs	N·m	in lbs	N·m	in lbs	N·m	in lbs	N·m
0.1	0.01	1	0.11	10	1.13	19	2.15	28	3.16
0.2	0.02	2	0.23	11	1.24	20	2.26	29	3.28
0.3	0.03	3	0.34	12	1.36	21	2.37	30	3.39
0.4	0.04	4	0.45	13	1.47	22	2.49	31	3.50
0.5	0.06	5	0.56	14	1.58	23	2.60	32	3.62
0.6	0.07	6	0.68	15	1.70	24	2.71	33	3.73
0.7	0.08	7	0.78	16	1.81	25	2.82	34	3.84
0.8	0.09	8	0.90	17	1.92	26	2.94	35	3.95
0.9	0.10	9	1.02	18	2.03	27	3.05	36	4.07

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ENGLISH TO METRIC CONVERSION: TORQUE

Torque is now expressed as either foot-pounds (ft./lbs.) or inch-pounds (in./lbs.). The metric measurement unit for torque is the Newton-meter (Nm). This unit—the Nm—will be used for all SI metric torque references, both the present ft./lbs. and in./lbs.

ft lbs	N-m	ft lbs	N-m	ft lbs	N-m	ft lbs	N-m
0.1	0.1	33	44.7	74	100.3	115	155.9
0.2	0.3	34	46.1	75	101.7	116	157.3
0.3	0.4	35	47.4	76	103.0	117	158.6
0.4	0.5	36	48.8	77	104.4	118	160.0
0.5	0.7	37	50.7	78	105.8	119	161.3
0.6	0.8	38	51.5	79	107.1	120	162.7
0.7	1.0	39	52.9	80	108.5	121	164.0
0.8	1.1	40	54.2	81	109.8	122	165.4
0.9	1.2	41	55.6	82	111.2	123	166.8
1	1.3	42	56.9	83	112.5	124	168.1
2	2.7	43	58.3	84	113.9	125	169.5
3	4.1	44	59.7	85	115.2	126	170.8
4	5.4	45	61.0	86	116.6	127	172.2
5	6.8	46	62.4	87	118.0	128	173.5
6	8.1	47	63.7	88	119.3	129	174.9
7	9.5	48	65.1	89	120.7	130	176.2
8	10.8	49	66.4	90	122.0	131	177.6
9	12.2	50	67.8	91	123.4	132	179.0
10	13.6	51	69.2	92	124.7	133	180.3
11	14.9	52	70.5	93	126.1	134	181.7
12	16.3	53	71.9	94	127.4	135	183.0
13	17.6	54	73.2	95	128.8	136	184.4
14	18.9	55	74.6	96	130.2	137	185.7
15	20.3	56	75.9	97	131.5	138	187.1
16	21.7	57	77.3	98	132.9	139	188.5
17	23.0	58	78.6	99	134.2	140	189.8
18	24.4	59	80.0	100	135.6	141	191.2
19	25.8	60	81.4	101	136.9	142	192.5
20	27.1	61	82.7	102	138.3	143	193.9
21	28.5	62	84.1	103	139.6	144	195.2
22	29.8	63	85.4	104	141.0	145	196.6
23	31.2	64	86.8	105	142.4	146	198.0
24	32.5	65	88.1	106	143.7	147	199.3
25	33.9	66	89.5	107	145.1	148	200.7
26	35.2	67	90.8	108	146.4	149	202.0
27	36.6	68	92.2	109	147.8	150	203.4
28	38.0	69	93.6	110	149.1	151	204.7
29	39.3	70	94.9	111	150.5	152	206.1
30	40.7	71	96.3	112	151.8	153	207.4
31	42.0	72	97.6	113	153.2	154	208.8
32	43.4	73	99.0	114	154.6	155	210.2

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ENGLISH TO METRIC CONVERSION: FORCE

Force is presently measured in pounds (lbs.). This type of measurement is used to measure spring pressure, specifically how many pounds it takes to compress a spring. Our present force unit (the pound) will be replaced in SI metric measurements by the Newton (N). This term will eventually see use in specifications for electric motor brush spring pressures, valve spring pressures, etc.

To convert pounds (lbs.) to Newton (N): multiply the number of lbs. by 4.45

lbs	N	lbs	N	lbs	N	oz	N
0.01	0.04	21	93.4	59	262.4	1	0.3
0.02	0.09	22	97.9	60	266.9	2	0.6
0.03	0.13	23	102.3	61	271.3	3	0.8
0.04	0.18	24	106.8	62	275.8	4	1.1
0.05	0.22	25	111.2	63	280.2	5	1.4
0.06	0.27	26	115.6	64	284.6	6	1.7
0.07	0.31	27	120.1	65	289.1	7	2.0
0.08	0.36	28	124.6	66	293.6	8	2.2
0.09	0.40	29	129.0	67	298.0	9	2.5
0.1	0.4	30	133.4	68	302.5	10	2.8
0.2	0.9	31	137.9	69	306.9	11	3.1
0.3	1.3	32	142.3	70	311.4	12	3.3
0.4	1.8	33	146.8	71	315.8	13	3.6
0.5	2.2	34	151.2	72	320.3	14	3.9
0.6	2.7	35	155.7	73	324.7	15	4.2
0.7	3.1	36	160.1	74	329.2	16	4.4
0.8	3.6	37	164.6	75	333.6	17	4.7
0.9	4.0	38	169.0	76	338.1	18	5.0
1	4.4	39	173.5	77	342.5	19	5.3
2	8.9	40	177.9	78	347.0	20	5.6
3	13.4	41	182.4	79	351.4	21	5.8
4	17.8	42	186.8	80	355.9	22	6.1
5	22.2	43	191.3	81	360.3	23	6.4
6	26.7	44	195.7	82	364.8	24	6.7
7	31.1	45	200.2	83	369.2	25	7.0
8	35.6	46	204.6	84	373.6	26	7.2
9	40.0	47	209.1	85	378.1	27	7.5
10	44.5	48	213.5	86	382.6	28	7.8
11	48.9	49	218.0	87	387.0	29	8.1
12	53.4	50	224.4	88	391.4	30	8.3
13	57.8	51	226.9	89	395.9	31	8.6
14	62.3	52	231.3	90	400.3	32	8.9
15	66.7	53	235.8	91	404.8	33	9.2
16	71.2	54	240.2	92	409.2	34	9.4
17	75.6	55	244.6	93	413.7	35	9.7
18	80.1	56	249.1	94	418.1	36	10.0
19	84.5	57	253.6	95	422.6	37	10.3
20	89.0	58	258.0	96	427.0	38	10.6

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CONVERSION FACTORS

LENGTH–DISTANCE

Inches (in.)	x 25.4	= Millimeters (mm)	x .0394	= Inches
Feet (ft.)	x .305	= Meters (m)	x 3.281	= Feet
Miles	x 1.609	= Kilometers (km)	x .0621	= Miles

VOLUME

Cubic Inches (in3)	x 16.387	= Cubic Centimeters	x .061	= in3
IMP Pints (IMP pt.)	x .568	= Liters (L)	x 1.76	= IMP pt.
IMP Quarts (IMP qt.)	x 1.137	= Liters (L)	x .88	= IMP qt.
IMP Gallons (IMP gal.)	x 4.546	= Liters (L)	x .22	= IMP gal.
IMP Quarts (IMP qt.)	x 1.201	= US Quarts (US qt.)	x .833	= IMP qt.
IMP Gallons (IMP gal.)	x 1.201	= US Gallons (US gal.)	x .833	= IMP gal.
Fl. Ounces	x 29.573	= Milliliters	x .034	= Ounces
US Pints (US pt.)	x .473	= Liters (L)	x 2.113	= Pints
US Quarts (US qt.)	x .946	= Liters (L)	x 1.057	= Quarts
US Gallons (US gal.)	x 3.785	= Liters (L)	x .264	= Gallons

MASS–WEIGHT

Ounces (oz.)	x 28.35	= Grams (g)	x .035	= Ounces
Pounds (lb.)	x .454	= Kilograms (kg)	x 2.205	= Pounds

PRESSURE

Pounds Per Sq. In. (psi)	x 6.895	= Kilopascals (kPa)	x .145	= psi
Inches of Mercury (Hg)	x .4912	= psi	x 2.036	= Hg
Inches of Mercury (Hg)	x 3.377	= Kilopascals (kPa)	x .2961	= Hg
Inches of Water (H_2O)	x .07355	= Inches of Mercury	x 13.783	= H_2O
Inches of Water (H_2O)	x .03613	= psi	x 27.684	= H_2O
Inches of Water (H_2O)	x .248	= Kilopascals (kPa)	x 4.026	= H_2O

TORQUE

Pounds–Force Inches (in–lb)	x .113	= Newton Meters (N·m)	x 8.85	= in–lb
Pounds–Force Feet (ft–lb)	x 1.356	= Newton Meters (N·m)	x .738	= ft–lb

VELOCITY

Miles Per Hour (MPH)	x 1.609	= Kilometers Per Hour (KPH)	x .621	= MPH

POWER

Horsepower (Hp)	x .745	= Kilowatts	x 1.34	= Horsepower

FUEL CONSUMPTION*

Miles Per Gallon IMP (MPG)	x .354	= Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L)	x 2.352	= IMP MPG
Miles Per Gallon US (MPG)	x .425	= Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L)	x 2.352	= US MPG

*It is common to covert from miles per gallon (mpg) to liters/100 kilometers (1/100 km), where mpg (IMP) x 1/100 km = 282 and mpg (US) x 1/100 km = 235.

TEMPERATURE

Degree Fahrenheit (°F) = (°C x 1.8) + 32

Degree Celsius (°C) = (°F – 32) x .56

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BASIC ELECTRICAL THEORY

Understanding Electricity

For any electrical system to operate, there must be a complete circuit. This simply means that the power flow from the battery must make a full circle. When an electrical component is operating, power flows from the battery to the components, passes through the component (load) causing it to function, and returns to the battery through the ground path of the circuit. This ground may be either another wire or a metal part of the vehicle (depending upon how the component is designed).

BASIC CIRCUITS

◗ **See Figures 1 and 2**

Perhaps the easiest way to visualize a circuit is to think of connecting a light bulb (with two wires attached to it) to the battery. If one of the two wires was attached to the negative post (-) of the battery and the other wire to the positive post (+), the circuit would be complete and the light bulb would illuminate. Electricity could follow a path from the battery to the bulb and back to the battery. Its not hard to see that with longer wires on our light bulb, it could be mounted anywhere on the vehicle. Further, one wire could be fitted with a switch so that the light could be turned on and off. Various other items could be added to our primitive circuit to make the light flash, become brighter or dimmer under certain conditions, or advise the user that its burned out.

Ground

Some automotive components are grounded through their mounting points. The electrical current runs through the chassis of the vehicle and returns to the battery through the ground (-) cable; if you look, you'll see that the battery ground cable connects between the battery and the body of the vehicle.

Load

Every complete circuit must include a "load" (something to use the electricity coming from the source). If you were to connect a wire between the two terminals of the battery (DON'T do this, but take out word for it) without the light bulb, the battery would attempt to deliver its entire power supply from one pole to another almost instantly. This is a short circuit. The electricity is taking a short cut to get to ground and is not being used by any load in the circuit. This sudden and uncontrolled electrical flow can cause great damage to other components in the circuit and can develop a tremendous amount of heat. A short in an automotive wiring harness can develop sufficient heat to melt the insulation on all the surrounding wires and reduce a multiple wire cable to one sad lump of plastic and copper. Two common causes of shorts are broken insulation (thereby exposing the wire to contact with surrounding metal surfaces or other wires) or a failed switch (the pins inside the switch come out of place and touch each other).

Switches and Relays

Some electrical components which require a large amount of current to operate also have a relay in their circuit. Since these circuits carry a large amount of current (amperage or amps), the thickness of the wire in the circuit (wire gauge) is also greater. If this large wire were connected from the load to the control switch on the dash, the switch would have to carry the high amperage load and the dash would be twice as large to accommodate wiring harnesses as thick as your wrist. To prevent these problems, a relay is used. The large wires in the circuit are connected from the battery to one side of the relay and from the opposite side of the relay to the load. The relay is normally open, preventing current from passing through the circuit. An additional, smaller wire is connected from the relay to the control switch for the circuit. When the control switch is turned on, it grounds the smaller wire to the relay and completes its circuit. The main switch inside the relay closes, sending power to the component without routing the main

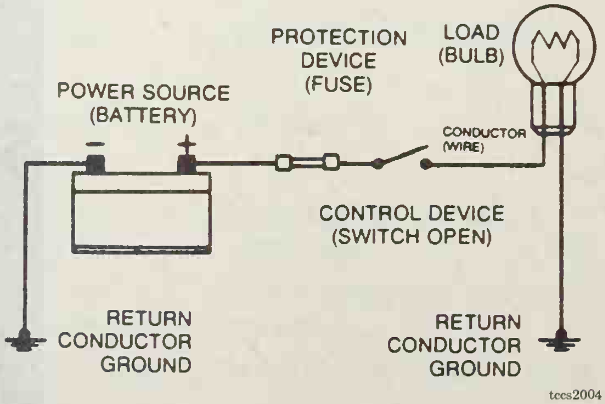

Fig. 1 Here is an example of a simple automotive circuit. When the switch is closed, power from the positive battery terminal flows through the fuse, then the switch and to the load (light bulb), the light illuminates and then, the circuit is completed through the return conductor and the vehicle ground. If the light did not work, the tests could be made with a voltmeter or test light at the battery, fuse, switch or bulb socket

Fig. 2 Damaged insulation can allow wires to break (causing an open circuit) or touch (causing a short)

power through the inside of the vehicle. Some common circuits which may use relays are the horn, headlights, starter and rear window defogger systems.

Protective Devices

It is possible for larger surges of current to pass through the electrical system of your vehicle. If this surge of current were to reach the load in the circuit, it could burn it out or severely damage it. To prevent this, fuses, circuit breakers and/or fusible links are connected into the supply wires of the electrical system. These items are nothing more than a built-in weak spot in the system. Its much easier to go to a known location (the fusebox) to see why a circuit is inoperative than to dissect 15 feet of wiring under the dashboard, looking for what happened.

When an electrical current of excessive power passes through the fuse, the fuse blows (the conductor melts) and breaks the circuit, preventing the passage of current and protecting the components.

A circuit breaker is basically a self repairing fuse. It will open the circuit in the same fashion as a fuse, but when either the short is removed or the surge subsides, the circuit breaker resets itself and does not need replacement.

A fuse link (fusible link or main link) is a wire that acts as a fuse. One of these is normally connected between the starter relay and the main wiring harness under the hood. Since the starter is usually the highest electrical draw on the vehicle, an internal short during starting could direct about 130 amps into the wrong places. Consider the damage potential of introducing this current into a system whose wiring is rated at 15 amps and you'll understand the need for protection. Since this link is very early in the electrical path, its the first place to look if nothing on the vehicle works, but the battery seems to be charged and is properly connected.

TROUBLESHOOTING

➧ **See Figures 3, 4 and 5**

Electrical problems generally fall into one of three areas:

- The component that is not functioning is not receiving current.
- The component is receiving power but is not using it or is using it incorrectly (component failure).
- The component is improperly grounded.

The circuit can be can be checked with a test light and a jumper wire. The test light is a device that looks like a pointed screwdriver with a wire on one end and a bulb in its handle. A jumper wire is simply a piece of wire with alligator clips or special terminals on each end. If a component is not working,

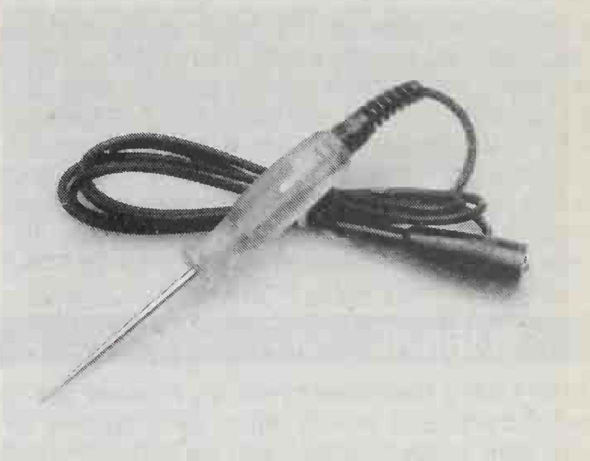

Fig. 3 A 12 volt test light is useful when checking parts of a circuit for power

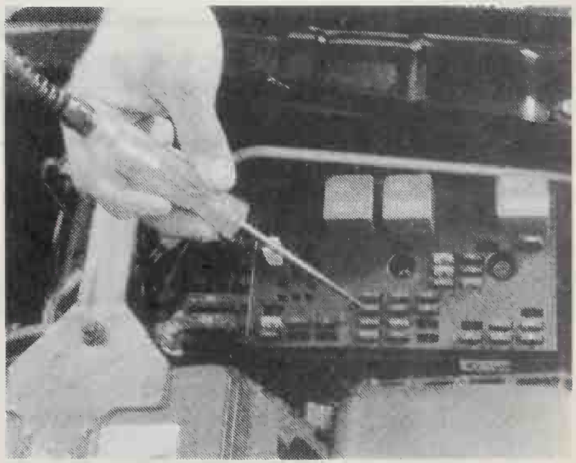

Fig. 4 Here, someone is checking a circuit by making sure there is power to the component's fuse

you must follow a systematic plan to determine which of the three causes is the villain.

1. Turn ON the switch that controls the item not working.

➡Some items only work when the ignition switch is turned ON.

2. Disconnect the power supply wire from the component.
3. Attach the ground wire of a test light or a voltmeter to a good metal ground.
4. Touch the end probe of the test light (or the positive lead of the voltmeter) to the power wire; if there is current in the wire, the light in the test light will come on (or the voltmeter will indicate the amount of voltage). You have now established that current is getting to the component.
5. Turn the ignition or dash switch **OFF** and reconnect the wire to the component.

If there was no power, then the problem is between the battery and the component. This includes all the switches, fuses, relays and the battery itself. The next place to look is the fusebox; check carefully either by eye or by using the test light across the fuse clips. The easiest way to check is to simply replace the fuse. If the fuse is blown, and upon replacement, immediately blows again, there is a short between the fuse and the component. This is generally (not always) a sign of an internal short in the component. Disconnect the power wire at the component again and replace the fuse; if the fuse holds, the component is the problem.

⁂WARNING

DO NOT test a component by running a jumper wire from the battery UNLESS you are certain that it operates on 12 volts. Many electronic components are designed to operate with less voltage and connecting them to 12 volts could destroy them. Jumper wires are best used to bypass a portion of the circuit (such as a stretch of wire or a switch) that DOES NOT contain a resistor and is suspected to be bad.

If all the fuses are good and the component is not receiving power, find the switch for the circuit. Bypass the switch with the jumper wire. This is done by connecting one end of the jumper to the power wire coming into the switch and the other end to the wire leaving the switch. If the component comes to life, the switch has failed.

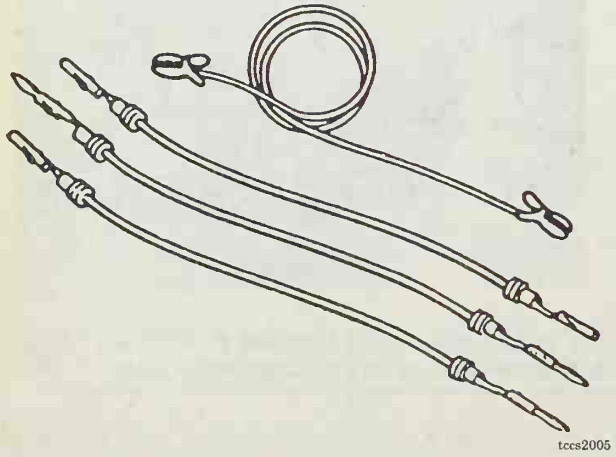

Fig. 5 Jumper wires with various connectors are handy for quick electrical testing

⁂WARNING

Never substitute the jumper for the component. The circuit needs the electrical load of the component. If you bypass it, you will cause a short circuit.

Checking the ground for any circuit can mean tracing wires to the body, cleaning connections or tightening mounting bolts for the component itself. If the jumper wire can be connected to the case of the component or the ground connector, you can ground the other end to a piece of clean, solid metal on the vehicle. Again, if the component starts working, you've found the problem.

A systematic search through the fuse, connectors, switches and the component itself will almost always yield an answer. Loose and/or corroded connectors, particularly in ground circuits, are becoming a larger problem in modern vehicles. The computers and on-board electronic (solid state) systems are highly sensitive to improper grounds and will change their function drastically if one occurs.

Remember that for any electrical circuit to work, ALL the connections must be clean and tight.

➡For more information on Understanding and Troubleshooting Electrical Systems, please refer to Section 6 of this manual.

Battery, Starting and Charging Systems

BASIC OPERATING PRINCIPLES

Battery

The battery is the first link in the chain of mechanisms which work together to provide cranking of the automobile engine. In most modern vehicles, the battery is a lead/acid electrochemical device consisting of six 2v subsections (cells) connected in series so the unit is capable of producing approximately 12v of electrical pressure. Each subsection consists of a series of positive and negative plates held a short distance apart in a solution of sulfuric acid and water.

The two types of plates are of dissimilar metals. This sets-up a chemical reaction, and it is this reaction which produces current flow from the battery when its positive and negative terminals are connected to an electrical accessory such as a lamp or motor. The continued transfer of electrons would eventually convert the sulfuric acid to water, and make the two plates identical in chemical composition. As electrical energy is removed from the battery, its voltage output tends to drop. Thus, measuring battery voltage and battery electrolyte composition are two ways of checking the ability of the unit to supply power. During engine cranking, electrical energy is removed from the battery. However, if the charging circuit is in good condition and the operating conditions are normal, the power removed from the battery will be replaced by the alternator which will force electrons back through the battery, reversing the normal flow, and restoring the battery to its original chemical state.

Starting System

The battery and starting motor are linked by very heavy electrical cables designed to minimize resistance to the flow of current. Generally, the major power supply cable that leaves the battery goes directly to the starter, while other electrical system needs are supplied by a smaller cable. During starter operation, power flows from the battery to the starter and is grounded through the vehicle's frame/body or engine and the battery's negative ground strap.

The starter is a specially designed, direct current electric motor capable of producing a great amount of power for its size. One thing that allows the motor to produce a great deal of power is its tremendous rotating speed. It drives the engine through a tiny pinion gear (attached to the starter's armature), which drives the very large flywheel ring gear at a greatly reduced speed. Another factor allowing it to produce so much power is that only intermittent operation is required of it. Thus, little allowance for air circulation is necessary, and the windings can be built into a very small space.

The starter solenoid is a magnetic device which employs the small current supplied by the start circuit of the ignition switch. This magnetic action moves a plunger which mechanically engages the starter and closes the heavy switch connecting it to the battery. The starting switch circuit usually consists of the starting switch contained within the ignition switch, a neutral safety switch or clutch pedal switch, and the wiring necessary to connect these in series with the starter solenoid or relay.

The pinion, a small gear, is mounted to a one way drive clutch. This clutch is splined to the starter armature shaft. When the ignition switch is moved to the **START** position, the solenoid plunger slides the pinion toward the flywheel ring gear via a collar and spring. If the teeth on the pinion and flywheel match properly, the pinion will engage the flywheel immediately. If the gear teeth butt one another, the spring will be compressed and will force the gears to mesh as soon as the starter turns far enough to allow them to do so. As the solenoid plunger reaches the end of its travel, it closes the contacts that connect the battery and starter, then the engine is cranked.

As soon as the engine starts, the flywheel ring gear begins turning fast enough to drive the pinion at an extremely high rate of speed. At this point, the one-way clutch begins allowing the pinion to spin faster than the starter shaft so that the starter will not operate at excessive speed. When the ignition switch is released from the starter position, the solenoid is de-energized, and a spring pulls the gear out of mesh interrupting the current flow to the starter.

Some starters employ a separate relay, mounted away from the starter, to switch the motor and solenoid current on and off. The relay replaces the solenoid electrical switch, but does not eliminate the need for a solenoid mounted on the starter used to mechanically engage the starter drive gears. The relay is used to reduce the amount of current the starting switch must carry.

Charging System

The automobile charging system provides electrical power for operation of the vehicle's ignition system, starting system and all electrical accessories. The battery serves as an electrical surge or storage tank, storing (in chemical form) the energy originally produced by the engine driven generator. The system also provides a means of regulating output to protect the battery from being overcharged and to avoid excessive voltage to the accessories.

The storage battery is a chemical device incorporating parallel lead plates in a tank containing a sulfuric acid/water solution. Adjacent plates are slightly dissimilar, and the chemical reaction of the two dissimilar plates produces electrical energy when the battery is connected to a load such as the starter motor. The chemical reaction is reversible, so that when the generator is producing a voltage (electrical pressure) greater than that produced by the battery, electricity is forced into the battery, and the battery is returned to its fully charged state.

Newer automobiles use alternating current generators or alternators, because they are more efficient, can be rotated at higher speeds, and have fewer brush problems. In an alternator, the field usually rotates while all the current produced passes only through the stator winding. The brushes bear against continuous slip rings. This causes the current produced to periodically reverse the direction of its flow. Diodes (electrical one way valves) block the flow of current from traveling in the wrong direction. A series of diodes is wired together to permit the alternating flow of the stator to be rectified back to 12 volts DC for use by the vehicle's electrical system.

The voltage regulating function is performed by a regulator. The regulator is often built in to the alternator; this system is termed an integrated or internal regulator.

ELECTRONIC DISTRIBUTOR IGNITION SYSTEM

General Information

In order to extract the best performance and economy from your engine it is essential that it be properly tuned at regular intervals. Although computerized engine controls and more durable components have reduced ignition maintenance, a regular tune-up will keep your Toyota's engine running smoothly and will prevent the annoying minor breakdowns and poor performance associated with an untuned engine.

Electronic ignition systems offer many advantages over the conventional breaker points ignition system. By eliminating the points, maintenance requirements are greatly reduced. An electronic ignition system is capable of producing much higher voltage which in turn aids in starting, reduces spark plug fouling and provides better emission control.

The system Toyota uses consists of a distributor with a signal generator, an ignition coil and an electronic igniter. The signal generator is used to activate the electronic components of the igniter. It is located in the distributor and consists of three main components; the signal rotor, the pick-up coil and the permanent magnet. The signal rotor (not to be confused with the distributor rotor) revolves with the distributor shaft, while the pick-up coil and the permanent magnet are stationary. As the signal rotor spins, the teeth on it pass a projection leading from the pick-up coil. When this happens, voltage is allowed to flow through the system, firing the spark plugs. There is no physical contact and no electrical arcing, hence no need to replace burnt or worn parts.

Service consists of inspection of the distributor cap, rotor and the ignition wires, replacing them as necessary. In addition, the air gap between the signal rotor and the projection on the pick-up coil should be checked periodically. The resistances of the coil and pick-up circuits should be measured periodically.

Adjustments

AIR GAP

➡The air gap is NOT adjustable. If the gap is not within specifications, the distributor must be replaced.

1. Remove the distributor cap. Inspect the cap for cracks, carbon tracks or a worn center contact. Replace it if necessary, transferring the wires one at a time from the old cap to the new one.
2. Pull the ignition rotor (not the signal rotor) straight up and remove it. Replace it if the contact is worn, burned or pitted. Do not file the contacts.
3. Turn the engine over (you may use a socket wrench on the front pulley bolt to do this) until the projection on the pickup coil is directly opposite the signal rotor tooth.
4. Use only a non-ferrous (paper, brass, or plastic) feeler gauge set. This means that they are non-magnetic; if you have any doubt, check the feeler with a magnet. If the magnet sticks, don't use that feeler gauge.
5. Select a non-ferrous feeler blade of 0.02 in. (0.30mm) thickness, and insert it into the pick-up air gap. The gauge should just touch either side of the gap. The permissible range is 0.008-0.016 in. (0.20-0.40mm) except for 1989-90 Land Cruisers. These vehicles require only that the gap be greater than 0.001 in. (0.2mm).

Diagnosis and Testing

PRECAUTIONS

- Do not allow the ignition switch to be **ON** for more than ten minutes if the engine will not start.
- When a tachometer is connected to the system, always connect the tachometer positive lead to the ignition coil negative terminal. Some tachometers are not compatible with this system; it is recommended that you consult with the manufacturer.
- NEVER allow the ignition coil terminals to touch ground as it could result in damage to the igniter and/or the ignition coil itself.
- Do not disconnect the battery when the engine is running.
- Make sure that the igniter is always properly grounded to the body

SPARK TEST

The spark test is used to see if the ignition system is delivering electricity through the coil wire to the distributor. Use this test a s a preliminary test if the engine cranks but won't start. Its a simple test, but can give a nasty shock if not performed correctly.

1. Disconnect the end of the coil wire at the distributor.
2. Use a well-insulated tool (such as ignition wire pliers) to hold the exposed end of the wire about ½ inch (13mm) from the metal of the engine block.

⁂CAUTION

Do not attempt to hold the wire with your bare hand. Use as much insulation as possible between the wire and the tool holding it. Do not stand on wet concrete while testing. Do not lean on the bodywork of the car while testing. The electrical charge will pass through the easiest path to ground, make certain its not you. Make sure the metal ground point nearest the cable end is safe; don't choose components that might contain fluids or electronic components.

3. Have an assistant crank the engine by turning the ignition switch to the **START** position, but only for 1 or 2 seconds. Keep clear of moving parts under the hood, and keep clothing and hair well out of the way. If the cable end is the correct distance from solid metal, a distinct, blue-white spark should jump to the metal as the engine cranks.
4. The engine may be cranked in the 1-2 seconds bursts. Longer cranking will cause the fuel injectors to deliver fuel into the cylinders, flooding the engine or at least fouling the spark plugs.
5. If no spark is present, turn the ignition switch **OFF** and proceed to check the resistance of the of the coil wire, the voltage supply to the coil (12 volts with the ignition **ON**), the coil resistance, the resistance of the pickup coil and the air gap within the distributor.

IGNITION COIL

1. With the ignition switch **OFF**, carefully remove the high-tension cable (coil-to-distributor wire) from the coil.
2. Carefully unplug the smaller electrical connector from the coil. The 1989-90 Land Cruisers and all 4 cylinder trucks and 4Runners do not have this small connector; battery wires run to external terminals on the coil. These terminals do not need to be undone.
3. Use an ohmmeter to test primary side resistance. Connect the probes to the 2 terminal pins of the small electrical connector or the two external terminals on each side of the coil.
4. Perform the check before running the engine. All the following values are on cold engines.

Resistance should be:

- 1989-91 — 22R engine: 0.4-0.5 ohms
- 1989-92 — 22R-E engine: 0.52-0.64 ohms
- 1993-95 — 22R-E engine: 0.36-0.55 ohms
- 1994-96 — 2RZ-FE and 3RZ-FE engines: 0.36-0.55 ohms

- 1989-91 — 3VZ-E engine: 0.4-0.5 ohms
- 1992-95 — 3VZ-E engine: 0.3-0.6 ohms
- 1989-90 — 3F-E engine: 0.52-0.64 ohms
- 1991 — 3F-E engine: 0.41-0.50 ohms
- 1992-96 — 1FZ-FE engine: 0.3-0.6 ohms

5. Check the secondary circuit resistance with the ohmmeter. Make certain the meter is set to a much higher scale than the previous test. Connect one probe of the meter to the positive coil terminal and the other to the high-tension terminal.

6. Correct resistances for a cold coil are:
    - 1989-91 — 22R engines: 8.5-11.5k ohms
    - 1989-92 — 22R-E engines: 11.4-15.6k ohms
    - 1993-95 — 22R-E engine: 9.0-15.4k ohms
    - 1989-91 — 3VZ-E engine: 10.2-13.8k ohms
    - 1992-95 — 3VZ-E engine: 9-15k ohms
    - 1994-96 — 2RZ-FE and 3RZ-FE engines: 9.0-15.4k ohms
    - 1989-90 — 3F-E engine: 11.5-15.5k ohms
    - 1991 — 3F-E engine: 10.2-13.8k ohms
    - 1992-96 — 1FZ-FE engine: 9-15k ohms

7. If either resistance is not within specifications, the coil must be replaced.

8. For the 1989 22R engine, measure resistance from the negative coil terminal to the body of the igniter. Resistance should be infinite (no continuity). If any continuity is found, replace the coil.

PICK-UP COIL(S)

1989-91 Models

1. Detach the distributor connector.
2. Remove the distributor cap without removing the spark-plug wires.
3. Remove the rotor.
4. With the ignition **OFF**, carefully detach the connector in the harness coming from the side of the distributor.
5. For 2-pin connectors, measure the resistance between the two terminals. Resistance for all 1989-90 vehicles is 140-180 ohms. For 1991 vehicles, resistance should be 205-255 ohms.
6. The 3-pin connectors are used on the Land Cruisers. Hold the connector so that the empty section of the 4-pin housing is in the lower left. The terminal in the lower right is called G-. Test each of the other terminals to G-, looking for resistance of 140-180 ohms on 1989-91 vehicles.
7. Four-pin connectors require you to hold the connector so that the square part of the housing is at the bottom. Viewing the connector in this position, the terminal on the lower right is called G-. Use the ohmmeter to check each other terminal to G-. Correct resistance for 1989-90 vehicles is 140-180 ohms; for 1991, it's 205-255 ohms.
8. If any resistance is out of specification, the distributor housing assembly must be replaced.

1992-95 Models

22R-E, 2RZ-FE and 3RZ-FE

1. Detach the distributor connector.
2. Remove the distributor cap without removing the spark-plug wires.
3. Remove the rotor.
4. With the ignition **OFF**, carefully detach the connector in the harness coming from the side of the distributor.
5. Using an ohmmeter, check the resistance of the signal generator (pick-up coil). With the engine cold, the reading should be 185-275 ohms; hot reading is 240-325 ohms.
6. If the resistance is not within specifications, replace the distributor housing assembly.

3VZ-E and 1FZ-FE

➧ See Figures 6, 7 and 8

1. Detach the distributor connector.
2. Remove the distributor cap without removing the spark-plug wires.
3. Remove the rotor.
4. Using an ohmmeter, check the resistance of the pick-up coil. Refer to the chart for specifications.
5. If the resistance is not within specifications, replace the distributor housing assembly.

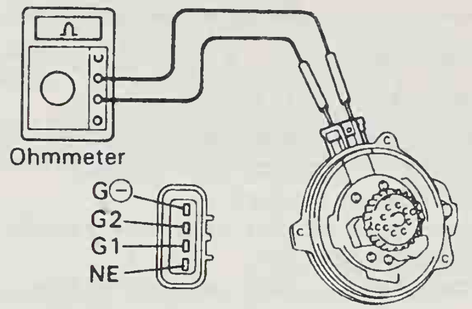

Fig. 6 Attach the ohmmeter to the terminals as shown

Pickup coil resistance	Cold (−10 ~ 50°C)	Hot (50 ~ 100°C)
G1 − G⊖	125 − 200 Ω	160 − 235 Ω
G2 − G⊖	125 − 200 Ω	160 − 235 Ω
NE − G⊖	155 − 250 Ω	190 − 290 Ω

86822gpq

Fig. 7 Pick-up coil resistance on the 3VZ-FE engine

Distributor	Air gap		0.2 – 0.4 mm (0.008 – 0.016 in.)
	Pickup coil resistance	at cold (G1 – G⊖)	185 – 275 Ω
		(G2 – G⊖)	185 – 275 Ω
		(NE – G⊖)	185 – 275 Ω
		at hot (G1 – G⊖)	240 – 325 Ω
		(G2 – G⊖)	240 – 325 Ω
		(NE – G⊖)	240 – 325 Ω

86822gpr

Fig. 8 Pick-up coil resistance on the 1FZ-FE engine

Ignition Coil

REMOVAL & INSTALLATION

External Mounted

➧ See Figures 9, 10, 11, 12 and 13

1. Disconnect the negative battery cable.
2. Remove the cover on the coil, if equipped.
3. Remove the coil wire lead.
4. Tag and disconnect all electrical leads to the coil. If applicable, remove the igniter.
5. Remove the two mounting bolts and lift off the ignition coil.

To install:

6. Install the coil in position and tighten the mounting bolts.
7. Connect all wires and install the igniter.
8. Connect the negative battery cable.

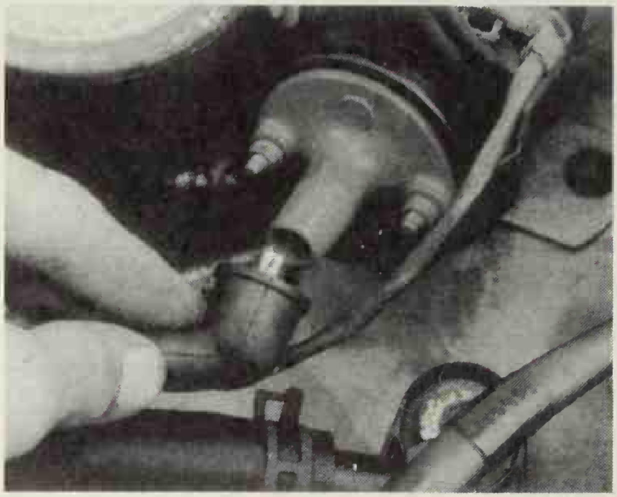

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Fig. 10 Detach the coil wire from the unit

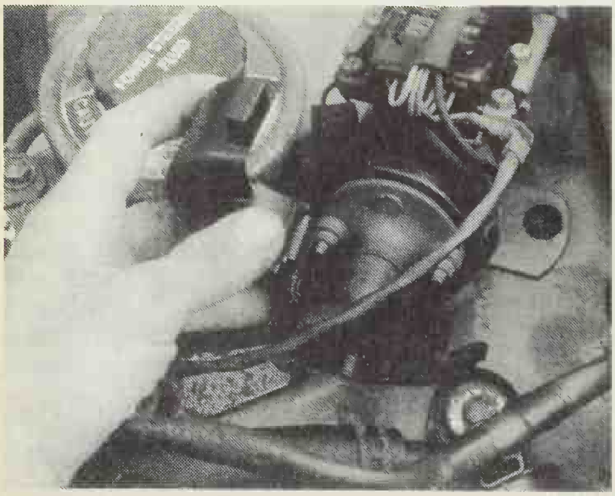

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Fig. 9 Remove the cover on the coil

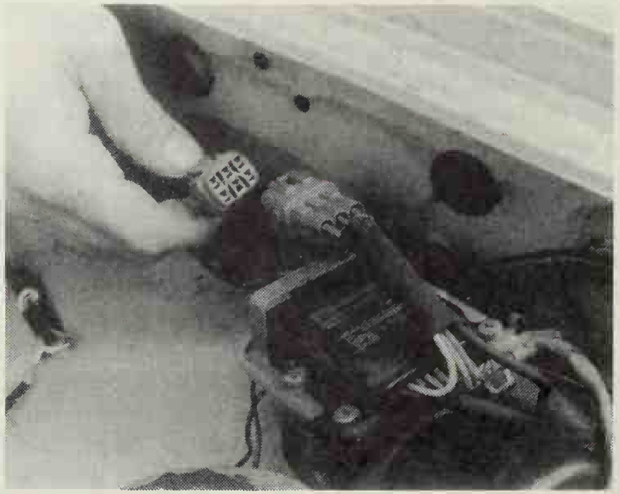

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Fig. 11 Unplug the connector and remove the igniter

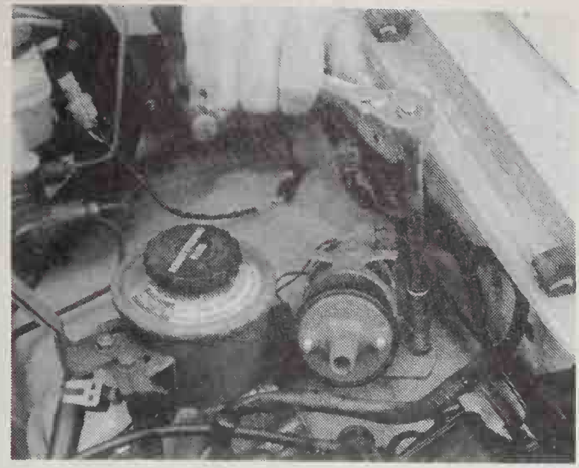
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Fig. 12 Loosen and remove the mounting bolts securing the coil

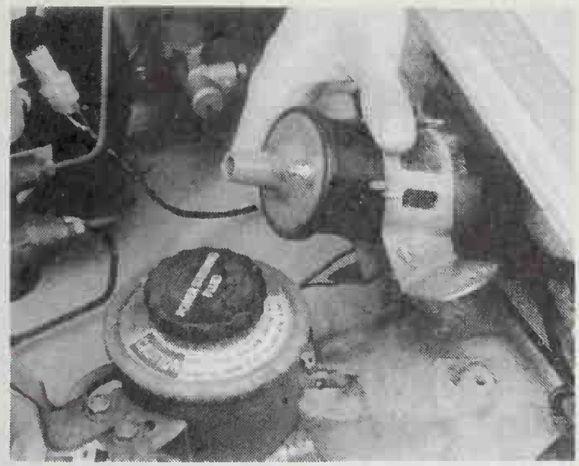
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Fig. 13 Once all leads and bolts are removed, lift the coil from the fenderwell

Internal Mounted

➧ **See Figure 14**

1. Disconnect the negative battery cable.
2. Remove the distributor cap and rotor.
3. Remove the ignition coil dust cover and dust proof packing.
4. Unfasten the two nuts and disconnect the three ignition coil terminals.
5. Remove the ignition coil retaining screws and the coil from the distributor.

To install:

6. Before installing, remove any old packing material from the ignition coil. Apply sealer 08826-00080 or equivalent to the coil mounting surface.
7. Install the ignition coil to the distributor with the four screws.

➡When connecting the wires for the ignition coil, be sure the wires do not contact with the signal rotor or distributor housing.

8. Connect the ignition coil wires and install the two nuts.
9. Install the dust proof packing and dust cover.
10. Install the rotor and distributor cap.
11. Connect the negative battery cable.

Igniter

REMOVAL & INSTALLATION

➧ **See Figures 15, 16, 17 and 18**

Igniters are mounted in one of two places on your Toyota truck. On the remotely mounted coils, the igniter is secured to the coil. On the integral coil vehicles (where the coil is in the distributor) the igniter is secured to the fenderwell.

1. Disconnect the negative battery cable.
2. Separate the wiring harness connections.
3. Unbolt the igniter.
4. If mounted to the coil, loosen the nut holding the wire lead.
5. Tag and disconnect the wire lead.
6. Lift the igniter off its mount.

To install:

7. Mount the igniter to the bracket.
8. Attach the wire lead to the coil if used.
9. Connect the harness.
10. Connect the negative battery cable.

Distributor

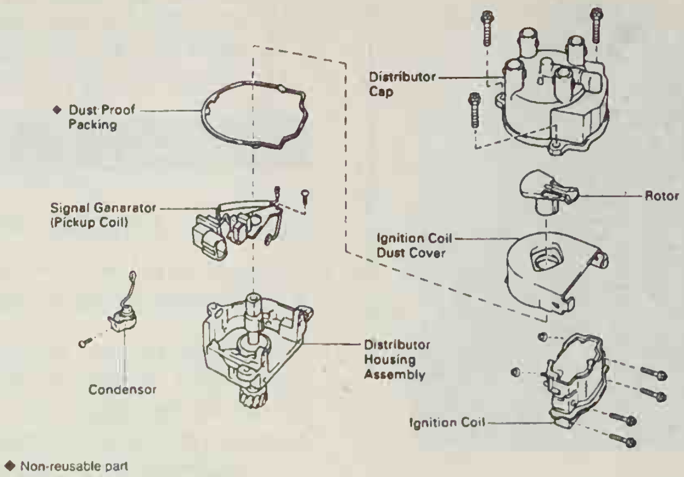
REMOVAL

➧ **See Figures 19, 20, 21, 22, 23 and 24**

1. Unfasten the retaining clips or remove the retaining screws and lift the distributor cap straight off. It will be easier to install the distributor if the wiring is left connected to the cap. If the wires must be removed from the cap, mark their positions to aid in installation.

➡Set cylinder No. 1 to TDC of the compression stroke. For all engines except 22R-E, set the timing mark at 0. On 22R-E, set the timing mark at 5 degrees.

2. Remove the dust cover and mark the position of the rotor relative to the distributor body; then mark the position of the body relative to the block.
3. Disconnect and tag any wires and the vacuum lines.
4. Remove the pinch-bolt and lift the distributor straight out, away from the engine. The rotor and body are marked so that they can be returned to the position from which they were removed. Do not turn or disturb the engine (unless absolutely necessary, such as for engine rebuilding), after the distributor has been removed. The relationship between the position of the distributor and the position of the engine is critical if the spark is to be sent to the proper place at the proper time.
5. Remove the distributor O-ring, discard and install a new one. Apply a light coat of engine oil on the O-ring.


◆ Dust Proof Packing
Signal Ganarator (Pickup Coil)
Condensor
Distributor Cap
Rotor
Ignition Coil Dust Cover
Distributor Housing Assembly
Ignition Coil
◆ Non-reusable part

86822015

Fig. 14 Exploded view of the internal mounted ignition coil distributor

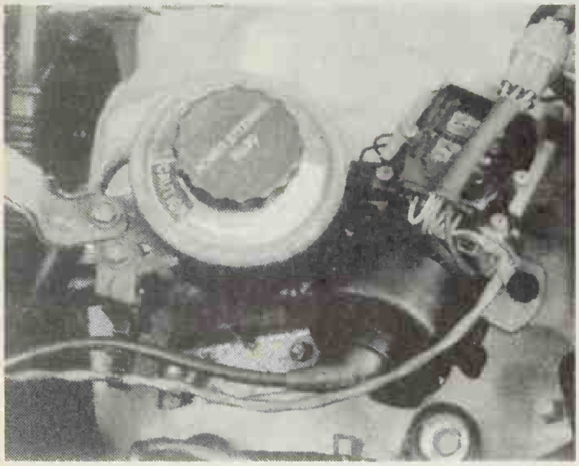


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Fig. 15 The igniter can be found mounted on the remote ignition coil

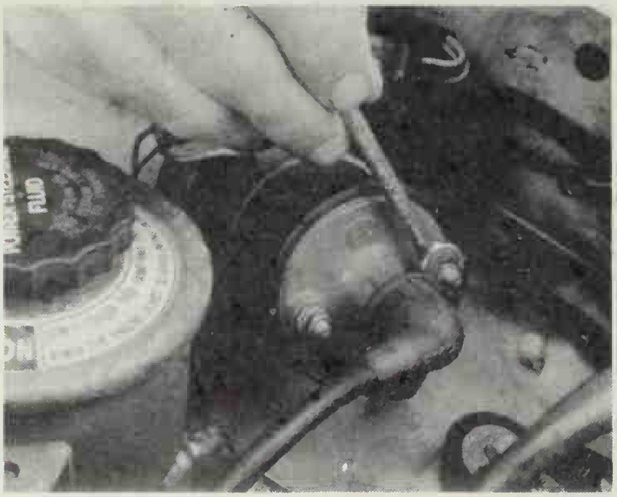

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Fig. 17 If mounted to the coil, detach the wire

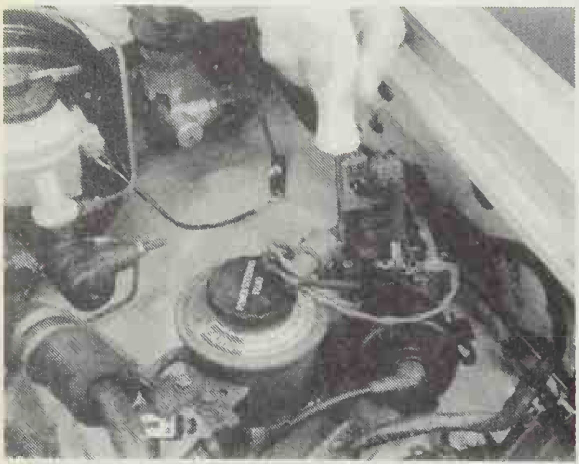

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Fig. 16 Unplug the connector and remove the retaining screws

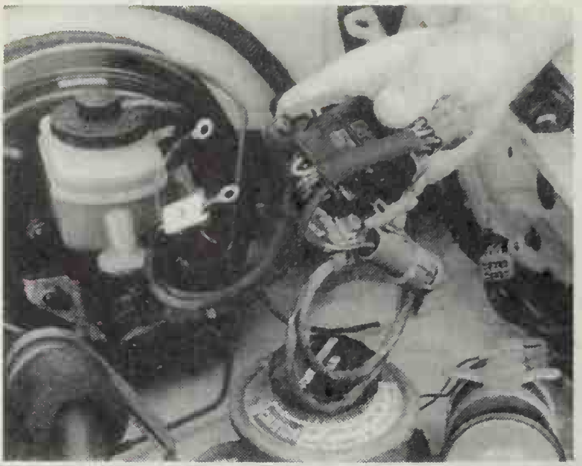

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Fig. 18 Check that all the connections are separated, then lift the unit from the vehicle

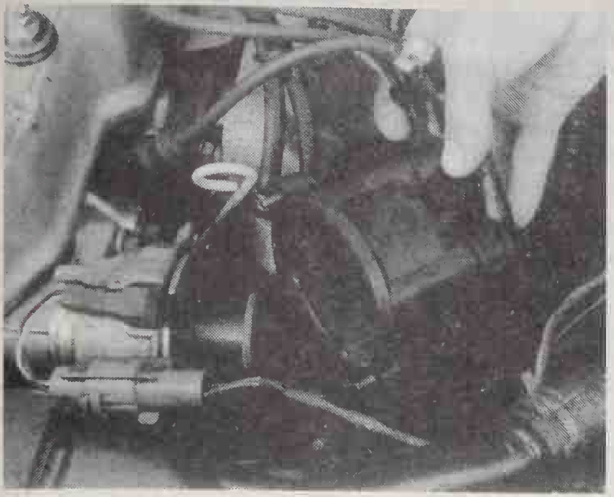
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Fig. 19 Remove the cap with the wires attached

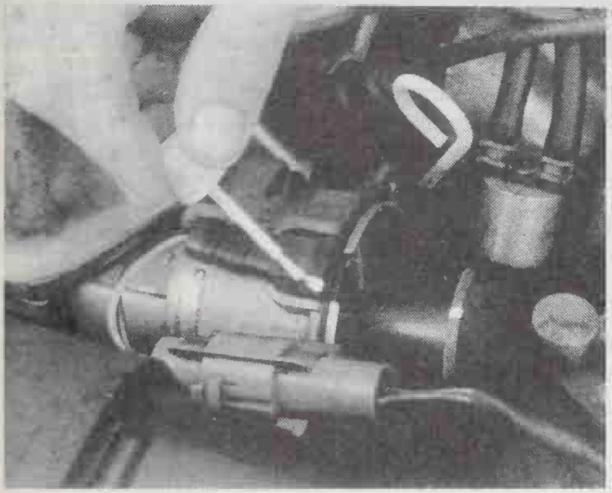
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Fig. 20 Mark the position of the rotor . . .

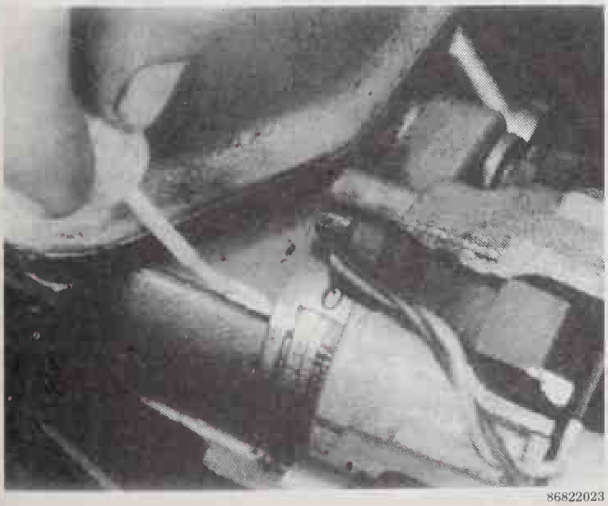
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Fig. 21 . . . and the distributor base

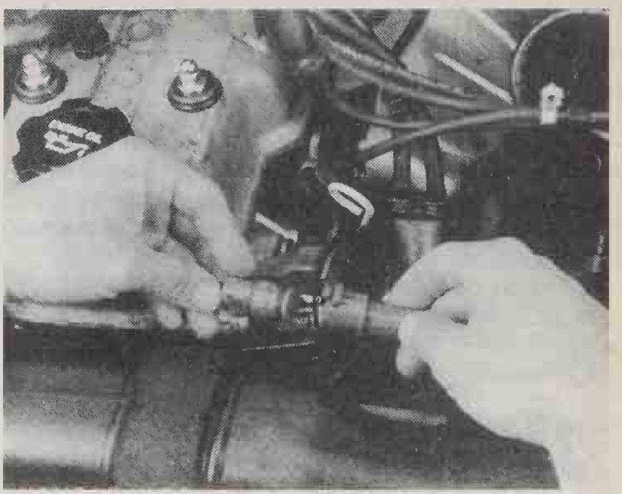
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Fig. 22 Detach the electrical connections

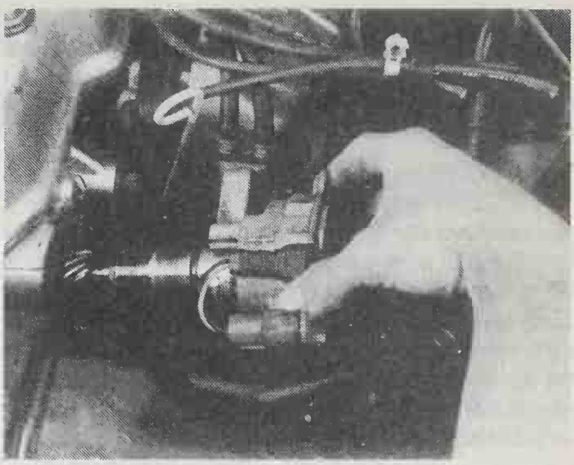
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Fig. 23 After the pinch-bolt is removed, pull the distributor out

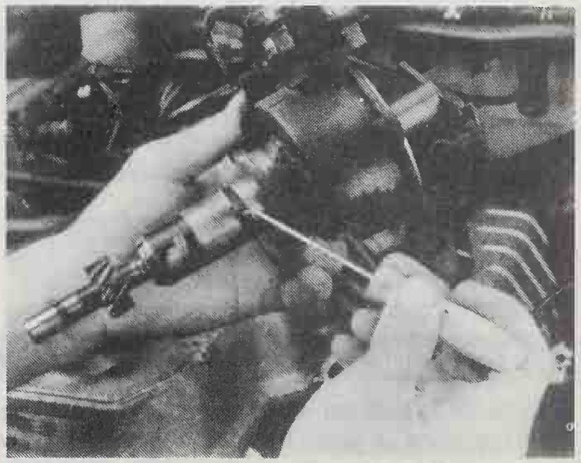
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Fig. 24 Discard the O-ring. A new one should be used during installation

INSTALLATION

Timing Not Disturbed

1. Align the matchmarks on the distributor with the rotor; position the distributor to align with the mark made on the block. Insert the distributor in the block, taking care not to damage the drive gear at the bottom or to knock all the marks out of alignment.
2. Tighten the pinch-bolt to 14 ft. lbs. (19 Nm).
3. Install the distributor cap and wires. Check the ignition timing.
4. Check the idle speed.

Timing Disturbed

If the engine has been cranked, dismantled, or the timing otherwise lost, proceed as follows:

1. Determine Top Dead Center (TDC) of the No. 1 cylinder's compression stroke by removing the spark plug from the No. 1 cylinder and placing your finger over the spark plug hole. Turn the engine (with a wrench on the crank pulley bolt) until the timing marks align at 0°, except on the 22R-E. On the 22R-E, align the mark at 5°. A definite compression can be felt pressing against your finger. Doing this important; the timing marks also align during the exhaust stroke, but no compression will be felt.

➡On engines which have the spark plugs buried into the manifold, use a compression gauge.

2. Install the rotor. Position the rotor so it is at the No. 1 cylinder firing position.
3. Slowly insert the distributor into the cylinder block.
4. Tighten the pinch-bolt to 14 ft. lbs. (19 Nm).
5. Install the distributor cap and wires. Check the ignition timing.
6. Check the idle speed.

DISTRIBUTORLESS IGNITION SYSTEM

General Information

The V6 5VZ-FE engines are equipped with what is called the Toyota Direct Ignition (TDI). This system improves the timing accuracy and enhances the overall reliability of the ignition system. The TDI uses a two-cylinder simultaneous (waste spark) ignition system which fires two cylinders at the same time with one coil.

In a waste spark system, one spark plug is attached to each end of the secondary coil winding. This circuit arrangement causes one of the plugs in each cylinder pair to fire in a forward direction, and the other to fire in a reverse direction. The cylinder on the compression stroke is defined as the "event" cylinder, while the cylinder in the exhaust stroke is called the "waste" cylinder. The coils are positioned over one bank of the plugs. This arrangement has eliminated half of the normal required plug wires.

Diagnosis and Testing

SYSTEM TEST

1. Disconnect a spark plug wire from a plug.
2. Remove the spark plug.
3. Reattach the spark plug to the wire.
4. Ground the spark plug.

⁂CAUTION

Do not attempt to hold the wire with your bare hand. Use as much insulation as possible between the wire and the tool holding it. Do not stand on wet concrete while testing. Do not lean on the bodywork of the car while testing. The electrical charge will pass through the easiest path to ground, make certain its not you. Make sure the metal ground point nearest the cable end is safe; don't choose components that might contain fluids or electronic components.

5. Check to see if a bright blue spark occurs when the engine is being cranked.

➡To prevent any gasoline from being injected during this test, crank the engine no more than 1-2 seconds at one time.

6. If the spark does not occur, perform the following:
   a. Check the connection to the ignition coil and igniter, if it is bad, connect it securely. If this is OK then proceed.
   b. Inspect the resistance of the wires, it should be 25k ohms. Replace the wires if not to specifications. If the wires are good proceed.
   c. Check the power supply to the coil and the igniter. Turn the ignition **ON**. Check that there is battery voltage at the ignition coil positive terminal. If not, check the wiring between the ignition switch to the coil and igniter assemblies. If this is OK, proceed.
   d. Check the resistance of the ignition coils, if not within specifications, replace the coil. If this is not correct replace the coil. If it is good, continue.
   e. Check the resistance of the camshaft position sensor (refer to Section 4). If this is not correct, replace the sensor. If this is correct, proceed.
   f. Check the resistance of the crankshaft position sensor (refer to Section 4). If this is not correct, replace the sensor. If this is correct, proceed.
   g. If the spark is still not present, check the wiring between the ECM, distributor and igniter. If the wiring is OK, replace the igniter.

Ignition Coil Pack

TESTING

◗ See Figure 25

➡This test may be performed while the engine is cold or hot. A cold engine has a coolant temperature of less than 122°F (50°C).

1. Remove the air cleaner cap and the Mass Air Flow (MAF) sensor assembly.
2. Disconnect the wires from the coils.
3. Disconnect the coil harnesses.
4. Inspect the primary coil resistance. Using a ohmmeter, measure the resistance between the positive and negative primary terminals.
   - Cold — 0.67-1.05 ohms
   - Hot — 0.85-1.23 ohms
5. If the coil resistance is not as noted, replace the coil.
6. Inspect the secondary coil resistance. Using a ohmmeter, measure the resistance between the positive primary terminal and the spark plug wire.
   - Cold — 9.3-16.0k ohms
   - Hot — 11.7-18.8k ohms
7. If the coil resistance is not as noted, replace the coil.
8. Reinstall the coils.
9. Reconnect the coil harnesses.
10. Install the wires to the coils.
11. Install the air cleaner cap and the MAF sensor.

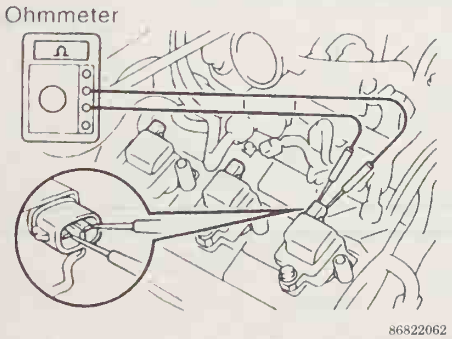

Fig. 25 Check the primary resistance as shown

REMOVAL & INSTALLATION

◗ See Figures 26 and 27

1. Remove the air cleaner cap and the Mass Air Flow (MAF) sensor assembly.
2. Disconnect and label the wires from the coils.
3. Unplug the connectors from the ignition coils. Remove the bolts and coils from the left cylinder head. Arrange the coils in the correct order for installation.

To install:

4. Install the coils on the cylinder heads in the reverse order of removal. Make certain the correct coil is replaced in the same place where it was removed. Tighten the mounting bolts to 69 inch lbs. (8 Nm).
5. Attach the plug wires to the coils.
6. Install the MAF sensor and the air cleaner cap.
7. Start the engine and check for proper operation.

Igniter

REMOVAL & INSTALLATION

The igniter is mounted on the fenderwell of your Toyota truck.

1. Disconnect the negative battery cable.
2. Unplug the wiring harness connections.
3. Remove the bolts retaining the igniter.
4. Lift the igniter off its mount.

To install:

5. Mount the igniter to the bracket. Tighten the bolts until snug.
6. Connect the harness.
7. Connect the negative battery cable.

Crankshaft Position Sensor

See Section 4 for information and procedures.

Camshaft Position Sensor

See Section 4 for information and procedures.

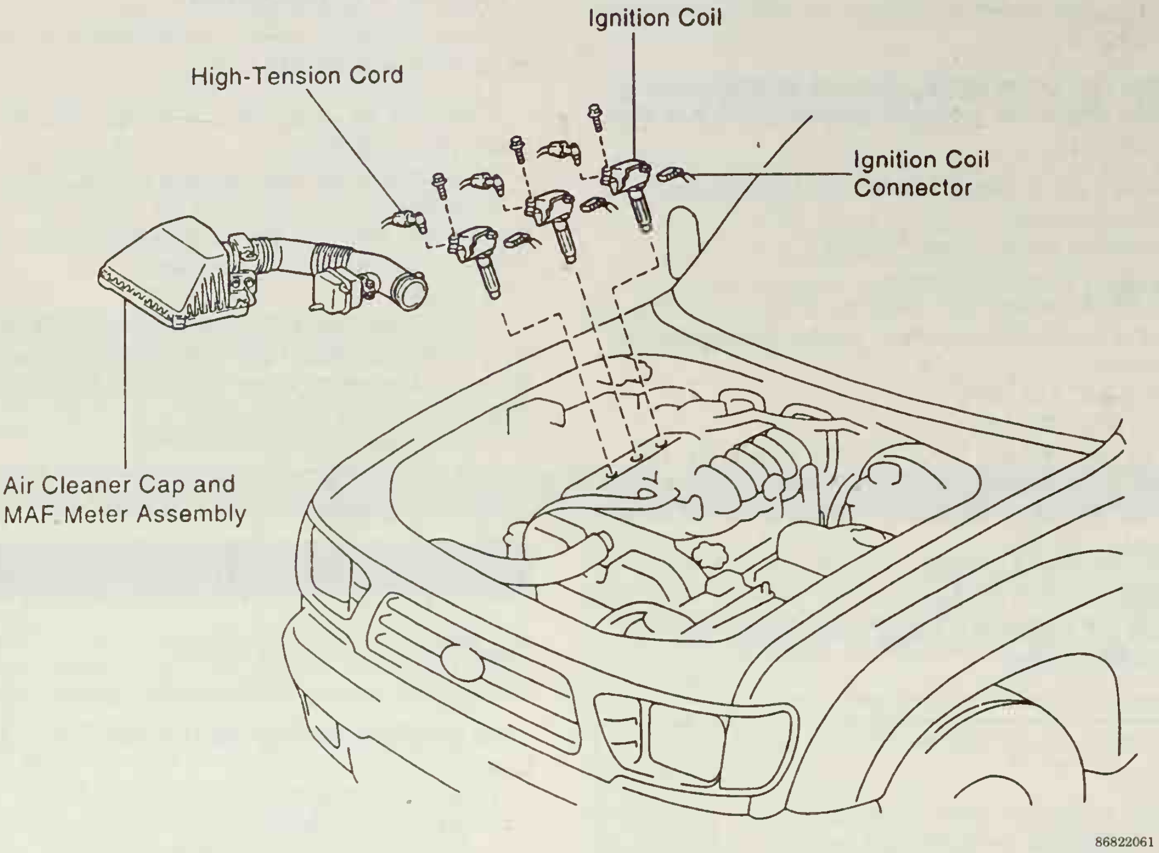
Ignition Coil
High-Tension Cord
Ignition Coil Connector
Air Cleaner Cap and MAF Meter Assembly
86822061

Fig. 26 Exploded view of the ignition coil mountings

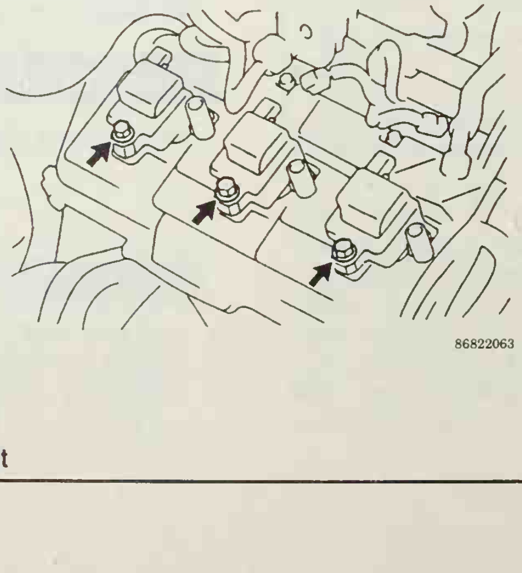

Fig. 27 Each coil is secured by a bolt

FIRING ORDERS

See Figures 28, 29, 30, 31, 32 and 33

The firing order is the order in which spark is sent to each cylinder. The spark must arrive at the correct time in the combustion cycle or damage may result. For this reason, connecting the correct plug to the correct distributor terminal is critical. To avoid confusion, always replace the spark plug wires one at a time.

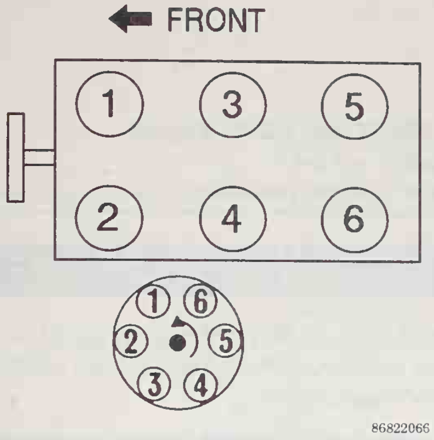
FRONT
1
3
5
2
4
6
1
6
2
5
3
4
86822066

Fig. 28 3VZ-E Engine
Firing order — 1-2-3-4-5-6
Distributor rotation: counterclockwise

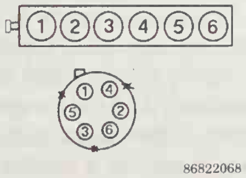
1
2
3
4
5
6
1
4
5
2
3
6
86822068

Fig. 29 1FZ-FE Engine
Firing order — 1-5-3-6-2-4
Distributor rotation: counterclockwise

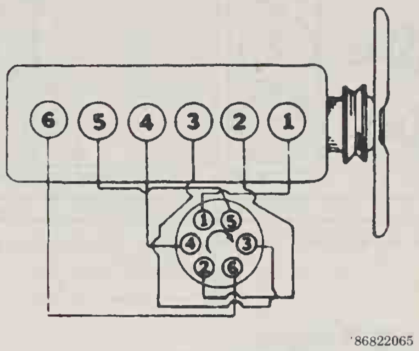
6
5
4
3
2
1
1
5
4
3
2
6
86822065

Fig. 30 3F-E Engine
Firing order — 1-5-3-6-2-4
Distributor rotation: clockwise

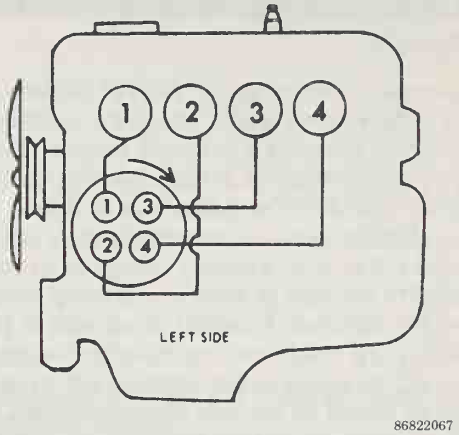
1
2
3
4
1
3
2
4
LEFT SIDE
86822067

Fig. 31 22R and 22R-E Engines
Firing order — 1-3-4-2
Distributor rotation: clockwise

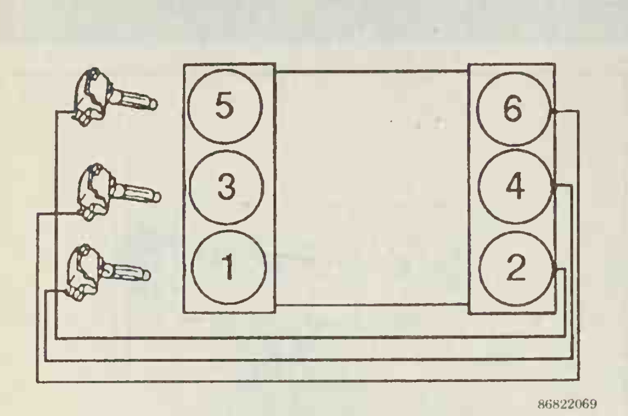

Fig. 32 5VZ-FE Engine
Firing order — 1-2-3-4-5-6
Distributorless ignition

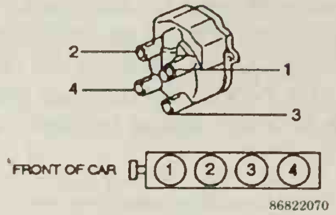

Fig. 33 2RZ-FE and 3RZ-FE Engines
Firing orders — 1-3-4-2
Distributor rotation: clockwise

CHARGING SYSTEM

General Information

See Figure 34

The automobile charging system provides electrical power for operation of the vehicle's ignition and all the electrical accessories. The battery serves as an electrical surge or storage tank, storing (in chemical form) the energy originally produced by the engine-driven alternator. The system also provides a means of regulating alternator output to protect the battery from being overcharged and to avoid excessive voltage to the accessories.

The vehicle's alternator is driven mechanically, through belts, by the engine crankshaft. It consists of two coils of fine wire, one stationary (the stator), and one movable (the rotor). The rotor may also be known as the armature, and consists of fine wire wrapped around an iron core which is mounted on a shaft. The electricity which flows through the two coils of wire (provided initially be the battery in some cases) creates an intense magnetic field around both the rotor and stator, and the interaction between the two fields creates voltage, allowing the alternator to power the accessories and charge the battery.

Almost all vehicles today use alternators because they are more efficient, can be rotated at higher speeds, and have fewer brush problems. In an alternator, the field rotates while all the current produced passes only through the stator windings. The brushes bear against continuous slip rings rather than a commutator. This causes the current produced to periodically reverse the direction of its flow, very similar to the power supply to your house. Diodes (electrical one-way switches) block the flow of current from traveling in the wrong direction. A series of diodes is wired together to permit the alternating flow of the stator to be converted to a pulsating, but unidirectional flow at the alternator output. This inverter circuit switches the AC current unusable by the vehicle to the standard DC or direct current. The alternator's field is wired in series with the voltage regulator.

The voltage regulator is contained within the alternator. Simply described, it consists of solid-state components whose job it is to limit the output of the alternator to usable levels. Excess output can damage the battery and overvoltage can destroy electrical components.

Alternator Precautions

To prevent damage to the alternator and regulator, the following precautionary measures must be taken when working with the electrical system.

- Never reverse the battery connections. Always check the battery polarity visually. This is to be done before any connections are made to ensure that all of the connections correspond to the battery ground polarity of the truck.
- Booster batteries must be connected properly. Make sure the positive cable of the booster battery is connected to the positive terminal of the battery which is getting the boost.
- Disconnect the battery cables before using a fast charger; the charger has a tendency to force current through the diodes in the opposite direction. This causes damage.
- Never use a fast charger as a booster for starting the truck.
- Never disconnect the voltage regulator while the engine is running.
- Do not ground the alternator output terminal.
- Do not operate the alternator on an open circuit with the field energized.
- Do not attempt to polarize the alternator.
- Disconnect the battery cables and remove the alternator before using an electric arc welder on the truck.
- Protect the alternator from excessive moisture. If the engine is to be steam cleaned, cover or remove the alternator.

Alternator

See Figure 35

All current trucks use a nominal 12 volt alternator. (Exact output should be slightly higher, generally 13.5-14.4 volts). Am-

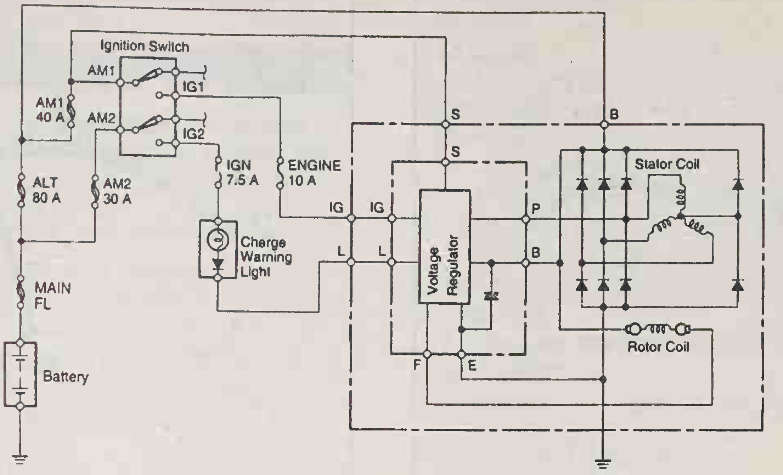
Ignition Switch
AM1
IG1
AM1
40 A
AM2
IG2
ALT
80 A
AM2
30 A
IGN
7.5 A
ENGINE
10 A
Charge
Warning
Light
MAIN
FL
Battery
S
S
B
IG
IG
L
L
P
B
Voltage Regulator
F
E
Stator Coil
Rotor Coil
86822090

Fig. 34 Charging system circuit

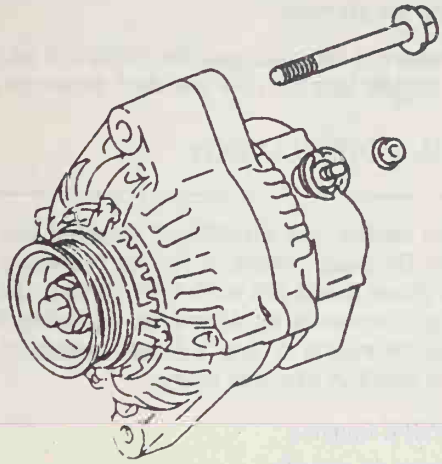

Fig. 35 A common alternator found on Toyota trucks

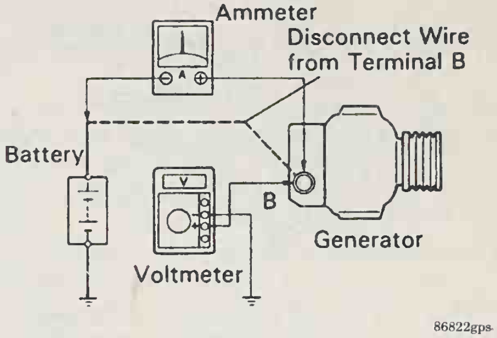
Ammeter
Disconnect Wire
from Terminal B
A
Battery
V
B
Generator
Voltmeter
86822gps

Fig. 36 Attach the ammeter and voltmeter as shown to test the charging system

perage ratings may vary according to the year, model and accessories. All have a transistorized, non-adjustable regulator, integrated with the alternator.

TESTING

▸ **See Figures 36, 37, 38, 39, 40 and 41**

➡If a battery/alternator tester is available, connect the tester to the charging circuit recommended by the manufacture's instructions.

If a tester is not available, connect a voltmeter and a ammeter to the charging circuit by doing the following:

1. Disconnect the wire from terminal (B) of the alternator and attach to the negative (-) lead of the ammeter.
2. Connect the positive (+) lead of the ammeter to terminal (B) of the alternator.
3. Connect the positive (+) lead of the voltmeter to terminal (B) of the alternator.
4. Ground the negative (-) lead of the voltmeter.
5. With the engine running from idle to 2000 rpm, check the reading on the ammeter and voltmeter. The standard amperage should be 10 A or less; standard voltage cold is 13.9-15.1 volts, and 13.5-14.3 volts hot. If the reading is greater than standard voltage, replace the regulator.

If the reading is less than the standard voltage, check the regulator and alternator:

6. With terminal (F) grounded, start the engine and check the voltmeter reading of terminal (B).
7. If the voltmeter reading is more than the standard voltage, replace the regulator.
8. If the voltmeter reading is less than standard voltage, the alternator may be faulty.
9. With the engine running at 2000 rpm turn on the high beam headlights and place the heater switch on high.
10. Check the reading on the ammeter. It should be 30 A or more.

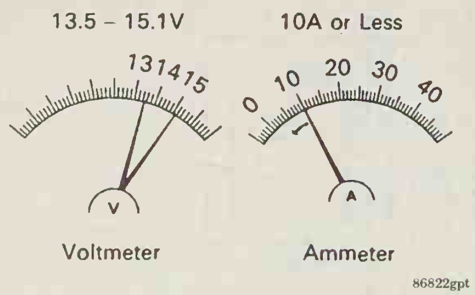
13.5 – 15.1V
10A or Less
13 14 15
0 10 20 30 40
V
A
Voltmeter
Ammeter
86822gpt

Fig. 37 With the engine running from idle to 2000 rpm, the readings should be as shown

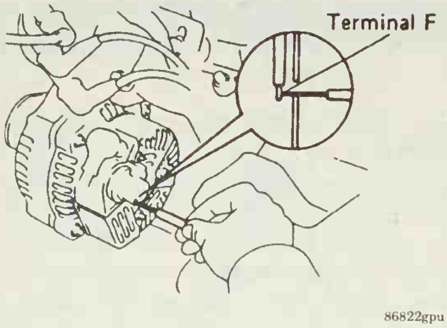
Terminal F
86822gpu

Fig. 38 With terminal (F) grounded, start the engine and check the voltmeter reading of terminal (B)

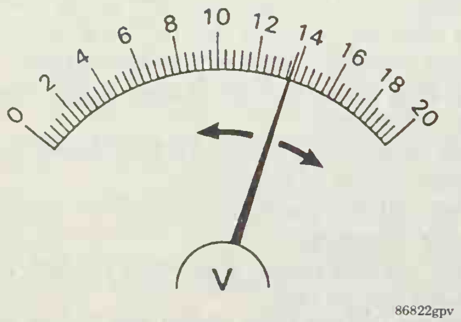
0 2 4 6 8 10 12 14 16 18 20
V
86822gpv

Fig. 39 Note whether the reading is above or below the standard voltage

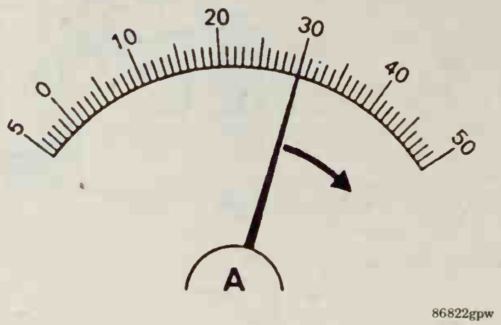
5 0 10 20 30 40 50
A
86822gpw

Fig. 40 The ammeter reading should be above 30 A

11. If the ammeter reading is less than the standard amperage, replace the alternator.

➡If the battery is fully charged, the indication will sometimes be slightly less than the standard amperage.

REMOVAL & INSTALLATION

➡On some models, the alternator is mounted very low on the engine. On these models, it may be necessary to remove the gravel shield and work from beneath the truck in order to gain access to the alternator. Replacing the alternator while the engine is cold is recommended. A hot engine can result in personal injury.

22R and 22R-E Engines

See Figures 42 and 43

1. Disconnect the negative battery terminal.

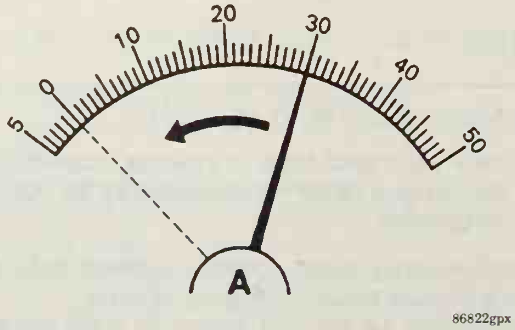
5 0 10 20 30 40 50
A
86822gpx

Fig. 41 If the ammeter reading is below the 30 A, replace the alternator

2. If the vehicle is equipped with power steering, drain the coolant from the system.

⁂WARNING

Housepets and small animals are attracted to the odor and taste of engine coolant (antifreeze). It is a highly poisonous mixture of chemicals; special care must be taken to protect open containers and spillage.

3. Disconnect the wiring at the back of the alternator. Lift the rubber boot, remove the nut from the external terminal and the wire.
4. If equipped with power steering, remove the engine splash shield or undercover, then the water inlet pipe.
5. If the truck has air conditioning, remove the No. 2 (lower) fan shroud.
6. Loosen the pivot bolt and remove the adjusting bolt.
7. Push the alternator towards the engine and remove the belt.

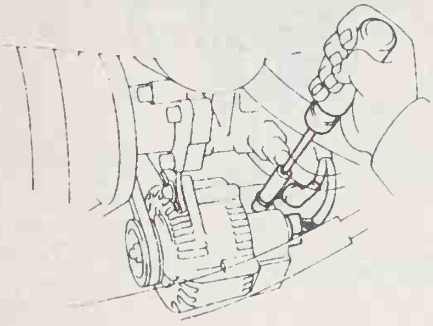

Fig. 42 Remove the nut and wire from the alternator

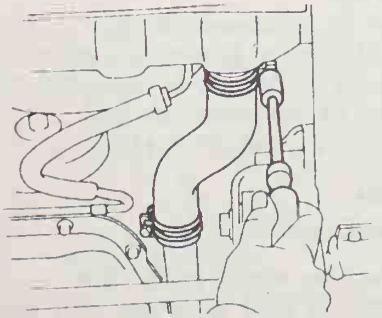

Fig. 43 If your vehicle has power steering, remove the water inlet pipe for ease of access

8. Hold the alternator; remove the pivot bolt then the alternator.

To install:

9. Mount the alternator on its bracket; install the pivot and adjusting bolts.
10. Install the drive belt and adjust it correctly. Tighten the pivot and adjusting bolts.
11. Install the water inlet hose if it was removed. Install the fan shroud and install the engine splash shield.
12. Connect the wire to the terminal; install the nut and secure the rubber boot. Attach the wire harness connector to the alternator.
13. Close the radiator drain cock and refill the system with coolant.
14. Connect the negative battery cable.

3VZ-E and 3F-E Engines

➧ See Figures 42 and 43

1. Disconnect the negative battery cable.
2. Disconnect the wiring at the back of the alternator. Lift the rubber boot, remove the nut from the external terminal and the wire.
3. Loosen the alternator pivot bolt and loosen the upper locknut.
4. Push the alternator towards the engine and remove the belt.
5. Remove the pivot and adjusting bolts. On 3F-E, remove the nuts and bolts holding the air pump support, then remove the adjusting bar and its bolts.
6. Remove the alternator.

To install:

7. Place the alternator in position and loosely install the pivot and adjusting bolts.
8. On 3F-E, install the adjusting bar and its 2 bolts. Set the nuts and bolts just snug. Install the air pump support.
9. Install the drive belt; adjust it to the proper tension, tightening the adjusting and pivot bolts. Tighten the 3F-E adjuster bar bolts.
10. Connect the wire to the terminal and install the nut. Fit the rubber boot over the terminal. Attach the plastic wire harness connector.
11. Connect the negative battery cable.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 44 and 45

1. Disconnect the negative battery cable.
2. Disconnect the wiring at the back of the alternator. Lift the rubber boot, remove the nut from the external terminal and the wire.
3. Loosen the alternator lockbolt, pivot bolt, nut and adjusting bolt.
4. Push the alternator towards the engine and remove the belt.
5. Remove the wiring harness with the clip.
6. Remove the alternator lockbolt, pivot bolt, nut.
7. Remove the alternator.

To install:

8. Place the alternator into position and loosely install the pivot and adjusting bolts.

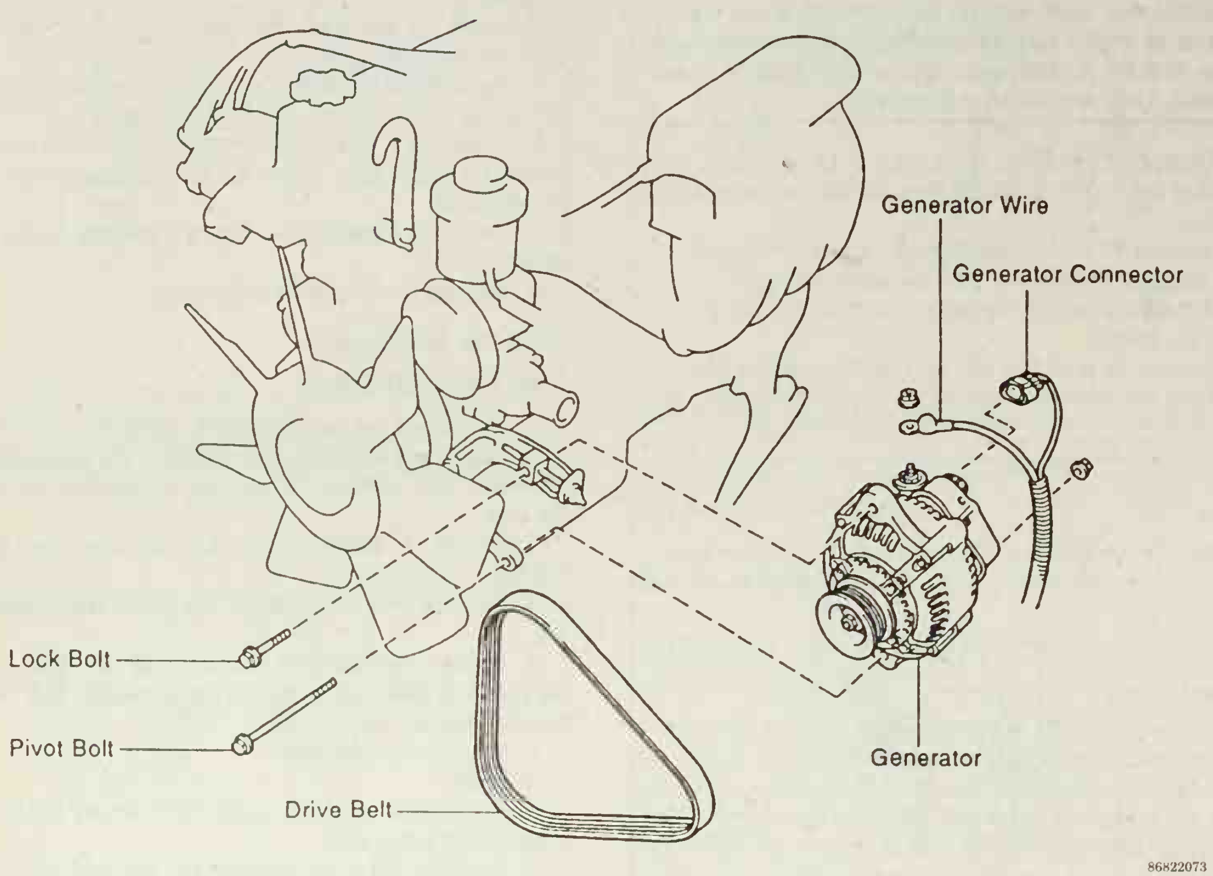
Generator Wire
Generator Connector
Lock Bolt
Pivot Bolt
Drive Belt
Generator
86822073

Fig. 44 Exploded view of the alternator and drive belt on the 2RZ-FE and 3RZ-FE engines

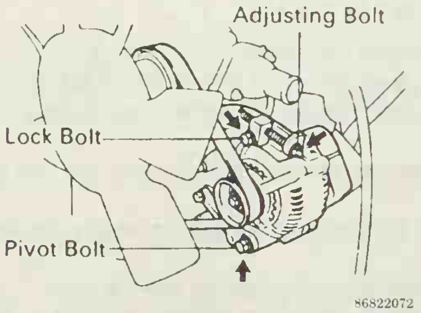
Adjusting Bolt
Lock Bolt
Pivot Bolt
86822072

Fig. 45 Locations of the adjusting, pivot and lockbolts

9. Install the drive belt; adjust it to the proper tension. Tighten the lockbolt to 21 ft. lbs. (29 Nm) and the pivot bolt to 43 ft. lbs. (59 Nm).
10. Connect the wire harness with clip.
11. Connect the wire to the terminal. Install the nut and tighten to 7 ft. lbs. (10 Nm). Fit the rubber boot over the terminal. Attach the wire harness connector.
12. Connect the negative battery cable.

5VZ-FE Engine

◗ See **Figures 46 and 47**

1. Disconnect the negative battery cable.
2. Disconnect the wiring at the back of the alternator. Lift the rubber boot, remove the nut from the external terminal and the wire.
3. Loosen the alternator locknut, pivot bolt, nut and adjusting bolt.
4. Push the alternator towards the engine and remove the belt.
5. Remove the alternator lockbolt, pivot bolt, nut.
6. Remove the alternator.

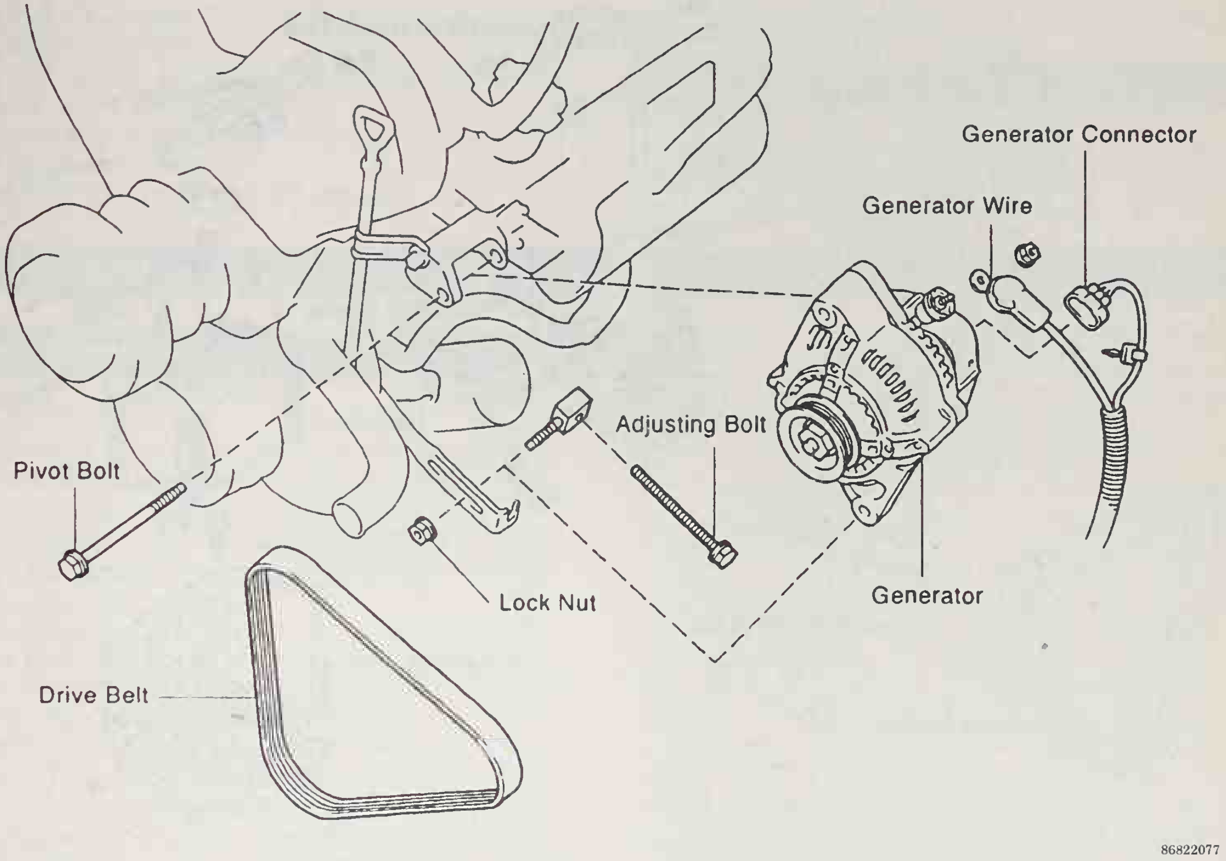
Generator Connector
Generator Wire
Adjusting Bolt
Pivot Bolt
Lock Nut
Generator
Drive Belt
86822077

Fig. 46 Exploded view of the alternator and drive belt on the 5VZ-FE engine

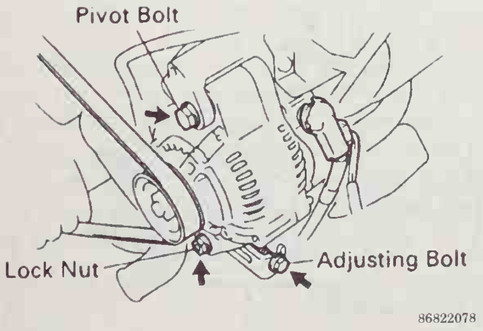
Pivot Bolt
Lock Nut
Adjusting Bolt
86822078

Fig. 47 Locations of the adjusting and pivot bolts and the locknut

To install:

7. Place the alternator into position and loosely install the pivot and adjusting bolts.
8. Install the drive belt; adjust it to the proper tension. Tighten the locknut 25 ft. lbs. (33 Nm) and the pivot bolt 38 ft. lbs. (51 Nm).
9. Connect the wire to the terminal and install the nut and tighten. Fit the rubber boot over the terminal. Attach the wire harness connector.
10. Connect the negative battery cable.

1FZ-FE Engine

➧ See Figures 48, 49 and 50

1. Disconnect the negative battery terminal.
2. Remove the battery and tray.
3. Disconnect the power steering reservoir tank.
4. Loosen the lock, pivot and adjusting bolts.
5. Remove the 2 drive belts.
6. Disconnect the wiring at the back of the alternator. Lift the rubber boot, remove the nut from the external terminal and the wire.

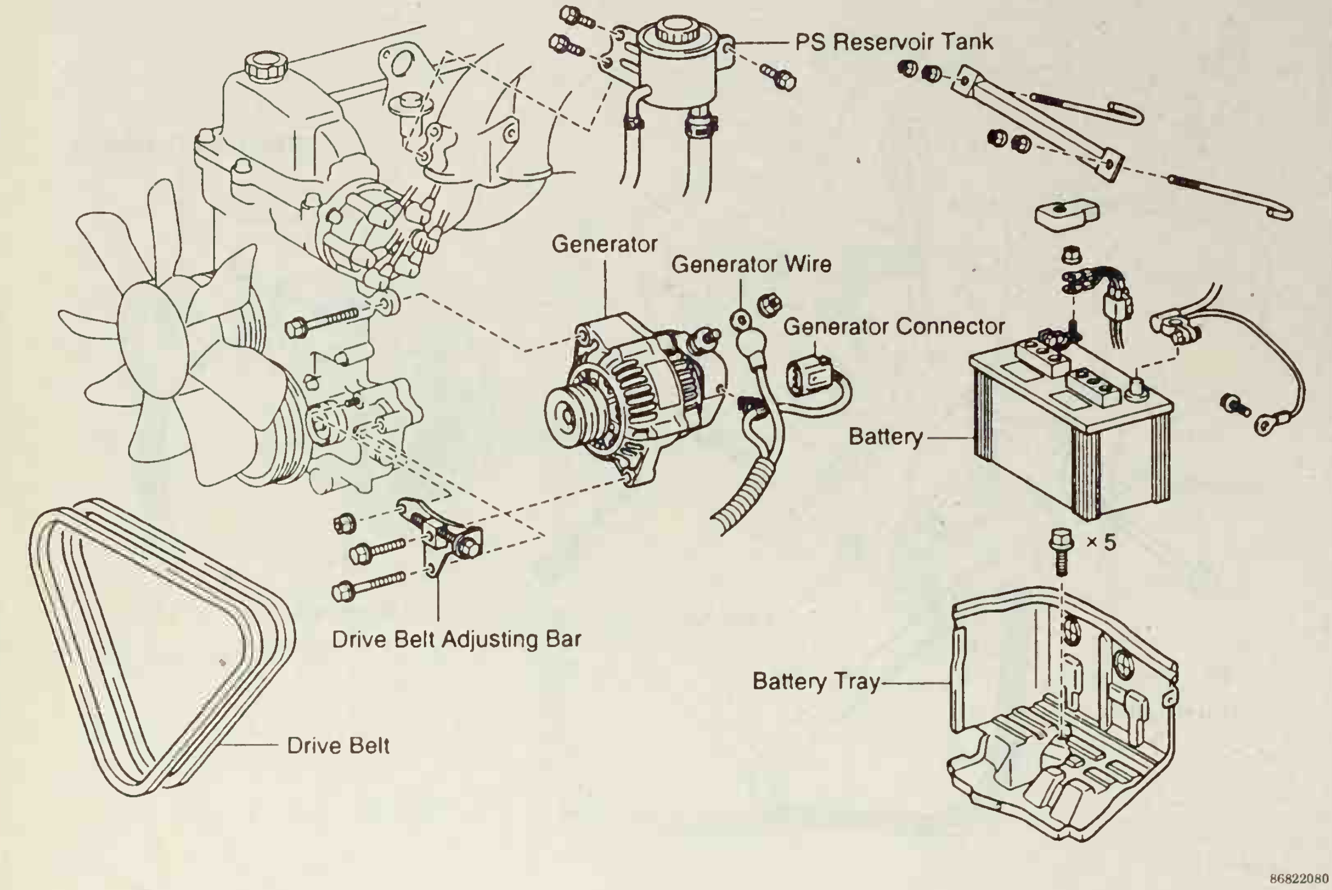
PS Reservoir Tank
Generator
Generator Wire
Generator Connector
Battery
× 5
Drive Belt Adjusting Bar
Battery Tray
Drive Belt
86822080

Fig. 48 Exploded view of the 1FZ-FE alternator, battery, belt etc. locations

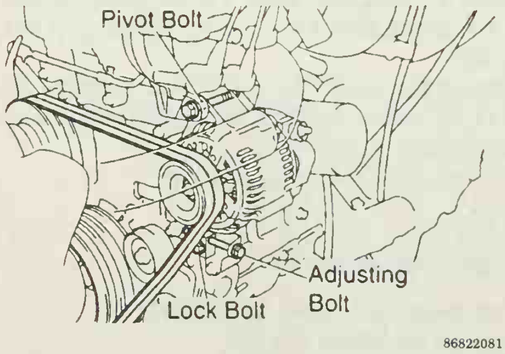
Pivot Bolt
Adjusting Bolt
Lock Bolt
86822081

Fig. 49 Lock, pivot and adjusting bolt locations

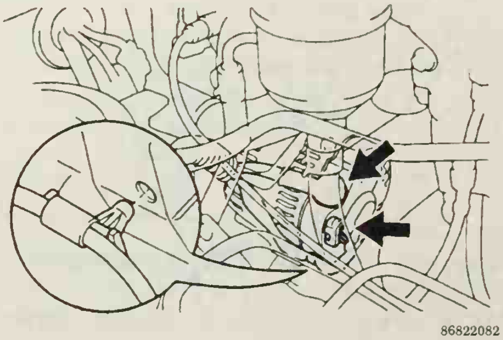

Fig. 50 The wiring clamp is mounted into the alternator as shown

7. Remove the wire clamp from the alternator.
8. Remove the lockbolt, nut and drive belt adjusting bar.
9. Hold the alternator; remove the pivot bolt then the alternator.

To install:

10. Mount the alternator ion the bracket with the pivot bolt. Do not tighten the bolt yet.
11. Install the drive belt adjusting bar with the bolt and nut. Tighten the bolt to 15 ft. lbs. (21Nm).
12. Temporarily install the lockbolt. Connect the alternator wiring, nut and rubber cap.
13. Connect the wire clamp to the alternator.
14. Install the drive belts.
15. Tighten the pivot bolt to 43 ft. lbs. (59 Nm) and the lockbolt to 15 ft. lbs. (21 Nm).
16. Connect the power steering reservoir tank.
17. Install the battery tray and battery.
18. Start the vehicle and check the alternator operation.

Regulator

All regulators are contained inside the case of the alternator and are not replaceable as a separate unit. If the regulator fails, the entire alternator must be replaced.

STARTING SYSTEM

General Information

➧ See Figure 51

The battery is the first link in the chain of items which work together to provide power of the automobile engine. In most modern trucks, the battery is a lead/acid electrochemical device consisting of six two-volt subsections connected in series so the unit is capable of producing approximately 12 volts of electrical pressure.

Each subsection, or cell, consists of a series of positive and negative plates held a short distance apart in a solution of sulfuric acid and water. The two types of plates are of dissimilar metals. This causes a chemical reaction and it is this reaction which produces current flow from the battery when its positive and negative terminals are connected to an electrical appliance such as a lamp or a motor. The continued transfer of electrons would eventually convert sulfuric acid in the electrolyte to water, and make the two plates identical in chemical composition. As electrical energy is removed from the battery, its voltage output tends to drop. Thus, measuring battery voltage and battery electrolyte composition are two ways of checking the ability of the unit to supply power. During the starting of the engine, electrical energy is removed from the battery. However, if the charging circuit is in good condition and the operating conditions are normal, the power removed from the battery will be replaced by the alternator which will force electrons back through the battery, reversing the normal flow, and restoring the battery to its original chemical state.

➡The battery only stores electrical energy, it does not produce it. The battery can only deliver power equal to what is stored within it. Thus, a low battery may not be able to supply enough power to crank the starter but will still operate the lights, horn and other lower amperage circuits. This should eliminate the famous line, "I know it's not the battery because the radio works..."

The battery and starting motor are linked by very heavy electrical cables designed to minimize resistance to the flow of current. Generally, the major power supply cable that leaves the battery goes directly to the starter, while other electrical needs are supplied by a smaller cable. During the starter operation, power flows from the battery to the starter and is grounded through the truck's frame and the battery's negative ground strap.

The starting motor is a specially designed, direct current electric motor capable of producing a very great amount of power for its size. One thing that allows the motor to produce a great deal of power is its tremendous rotating speed. It drives the engine through a tiny pinion gear (attached to the starter's armature), which drives the very large flywheel ring gear at a greatly reduced speed. Another factor allowing it to produce so much power is that only intermittent operation is required of it. Thus, little allowance for air circulation is required, and the windings can be built into a very small space.

The starter solenoid is a magnetic device which employs the small current supplied by the ignition switch. The magnetic action moves a plunger which mechanically engages the starter and electrically closes the heavy switch which connects it to the battery. The starting circuit consists of the starting signal controlled by the ignition switch, a transmission neutral safety switch or clutch pedal switch, and the wiring necessary to connect these with the starter solenoid or relay. Since the circuit has multiple switches, all must be in the ON position for the system to operate.

As soon as the engine starts, the flywheel ring gear begins turning fast enough to drive the pinion at an extremely high rate of speed. At this point, the one-way clutch begins allowing the pinion to spin faster than the starter shaft so that the starter will not operate at excessive speed. (This overrun condition is similar to riding a bicycle downhill; the rear wheel is turning faster than the chain sprocket.) When the ignition switch is released from the starter position, the solenoid is de-energized, and a spring in the solenoid assembly pulls the gear out of mesh and interrupts the current flow to the starter.

Some starters employ a separate relay, mounted away from the starter, to switch the motor and solenoid current on and off. The relay replaces the solenoid electrical switch, but does not eliminate the need for a solenoid mounted on the starter to mechanically engage the starter drive gears. The relay is used to reduce the amount of current the starting switch must carry.

Starter

TESTING

➡These tests must be performed within a 3 to 5 seconds to avoid burning out the coil.

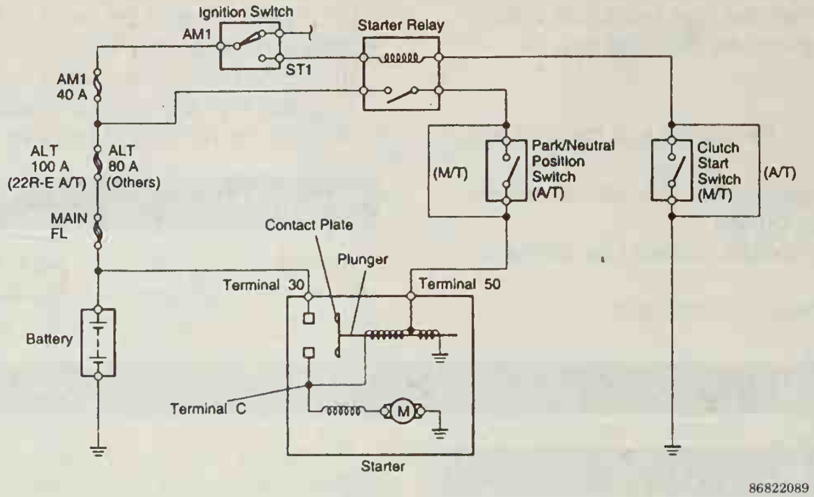
Ignition Switch
AM1
ST1
Starter Relay
AM1
40 A
ALT
100 A
(22R-E A/T)
ALT
80 A
(Others)
MAIN
FL
Battery
(M/T)
Park/Neutral
Position
Switch
(A/T)
Clutch
Start
Switch
(M/T)
(A/T)
Contact Plate
Plunger
Terminal 30
Terminal 50
Terminal C
M
Starter
86822089

Fig. 51 Starting system circuit diagram

Pull-in

➧ See Figure 52

1. Disconnect the field coil lead wire from terminal C.
2. Connect the battery to the magnetic switch shown in the diagram.
3. Check that the clutch pinion gear moves in the outward motion.

Hold-in

➧ See Figure 53

With the battery connected as in the picture and with the clutch pinion gear out, disconnect the negative (-) lead from terminal C. Check that the pinion gear stays in the outward position.

Inspect Clutch Pinion Gear Return

➧ See Figure 54

Disconnect the negative lead from the magnetic switch body. Check that the pinion gear returns to the inward position.

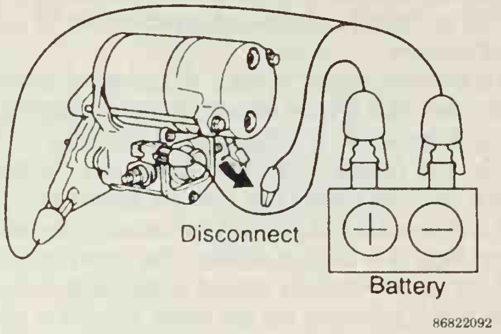
Disconnect
+
−
Battery
86822092

Fig. 53 Connect the battery as shown here to test the hold-in windings

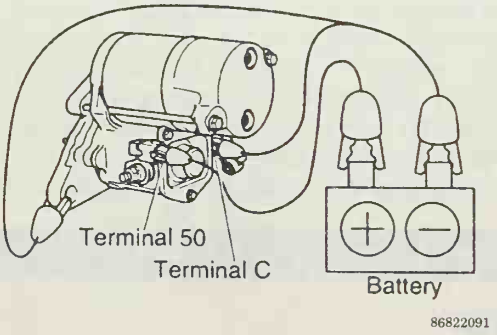
Terminal 50
Terminal C
+
−
Battery
86822091

Fig. 52 Connect the battery to the magnetic switch as shown here

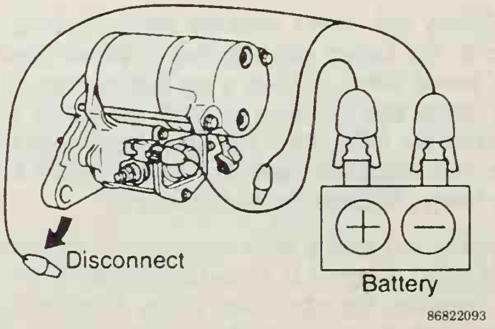
Disconnect
+
−
Battery
86822093

Fig. 54 Disconnect the negative lead from the starter as shown here

No-Load

➧ See Figure 55

1. Connect the battery ammeter to the starter as shown in the illustration.
2. Check the rotation of the starter, it must be smooth and steady with the pinion gear moving outwards. Compare the ammeter reading to the starter specifications chart.

REMOVAL & INSTALLATION

➧ See Figure 56

➡Replacing the starter while the engine is cold is recommended. A hot engine can result in personal injury.

1. Disconnect the negative battery cable.
2. Remove the nut and disconnect the battery cable from the magnetic switch on the starter motor.
3. Disconnect the remaining electrical connections at the starter.
4. Remove the nuts and/or bolts securing the starter to the bell housing, then pull the starter toward the front of the vehicle to remove.

To install:

5. Insert the starter into the bell housing being sure that the starter drive teeth are engaged with the flywheel teeth, not jammed against the flywheel.
6. Tighten the attaching hardware to 29 ft. lbs. (39 Nm) and replace all electrical connections.
7. Connect the positive battery cable (starter wire) to the starter.

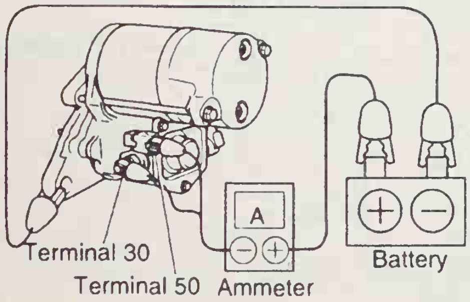

Fig. 55 Make the connections to the battery, ammeter and starter as shown here

8. Connect the negative battery cable.

RELAY REPLACEMENT

➧ See Figure 57

The starter relays on most of your Toyota trucks are located either in the relay block in the engine compartment or on the driver's side junction block. The cover for the relay compartments should be marked, "starter" or the relay will have a part number with a suffix of 28300-XXXXX. Simply locate the relay, pull it out, and install a new one if needed.

Battery

REMOVAL & INSTALLATION

➡Refer to Section 1 for details on battery maintenance.

1. Disconnect the negative battery cable from the terminal, then disconnect the positive cable. Special pliers and pullers are available to remove the clamps. Be careful of the many wires and fittings on and around the positive terminal.

➡To avoid sparks, always disconnect the negative cable first and reconnect it last.

2. Unscrew and remove the battery hold down clamp.
3. Remove the battery, being careful not to spill any of the acid.

➡Spilled acid can be neutralized with a baking soda and water solution. If you somehow get acid into your eyes, flush it out with lots of clean water and get to a doctor as quickly as possible.

4. Clean the battery posts thoroughly before reinstalling or when installing a new one. A light coating of petroleum jelly or battery terminal spray protectant will help fight corrosion.
5. Clean the cable clamps using the special tools or a wire brush, both inside and out.
6. Install the battery, and the hold down clamp. Connect the positive and then the negative cable. Do not hammer them into place. The terminals should be coated with grease to prevent corrosion.

⁂CAUTION

Make absolutely sure that the battery is connected properly before you turn on the ignition switch. Reversed polarity can burn out an alternator in a matter of seconds.

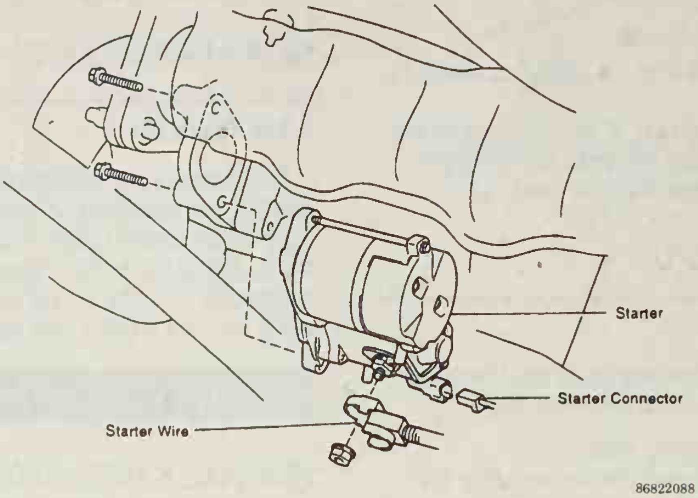
Starter
Starter Connector
Starter Wire
86822088

Fig. 56 Exploded view of a common starter mounting found on Toyota trucks

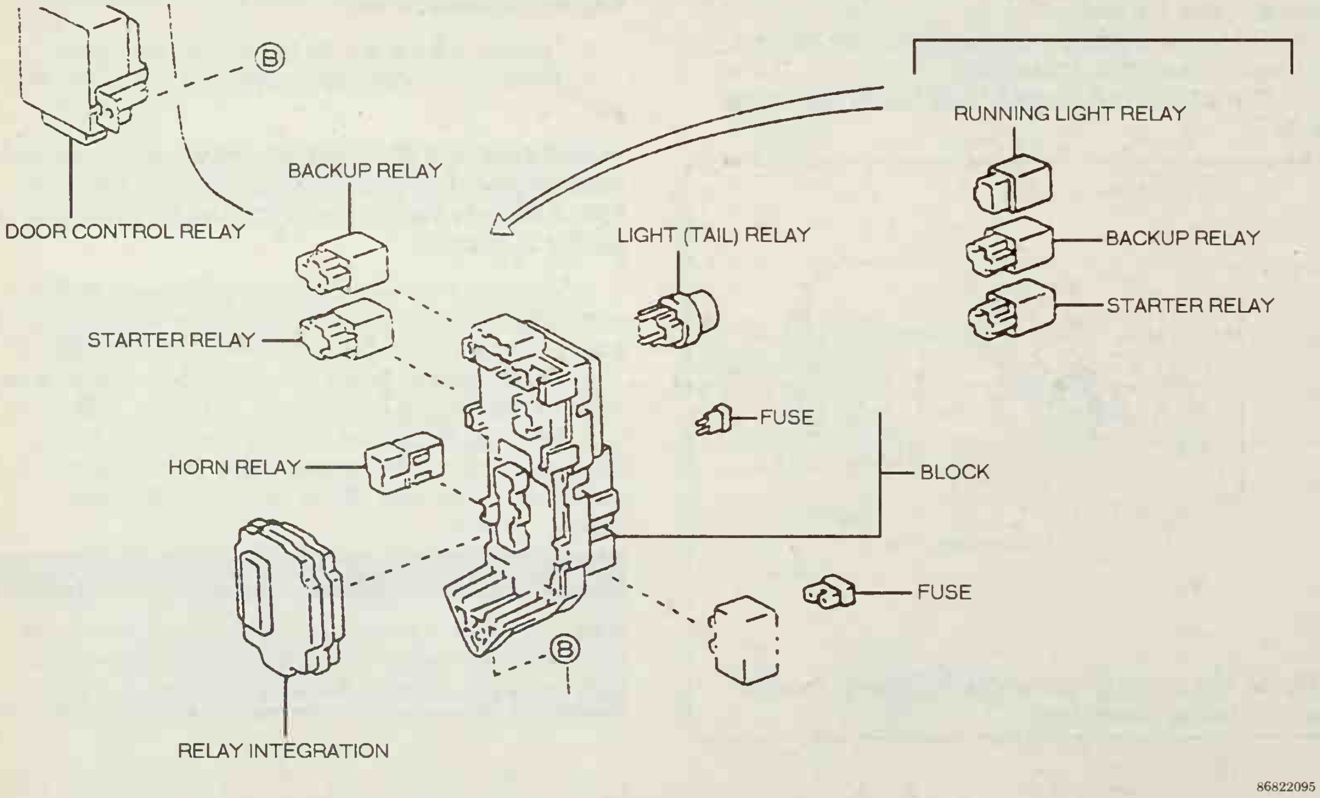
B
DOOR CONTROL RELAY
BACKUP RELAY
STARTER RELAY
HORN RELAY
RELAY INTEGRATION
B
LIGHT (TAIL) RELAY
FUSE
BLOCK
FUSE
RUNNING LIGHT RELAY
BACKUP RELAY
STARTER RELAY
86822095

Fig. 57 The relay may be located in the driver's side junction block or in the engine compartment relay block

STARTER SPECIFICATIONS

Year	Model	Engine	No-Load Test		
			Max. Amps	Max. Volts	RPM
1989	Pickup	22R	90	11.5	①
		22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R	90	11.5	①
		22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	Land Cruiser	3F-E	90	11.5	3000
1990	Pickup	22R	90	11.5	①
		22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	Land Cruiser	3F-E	90	11.5	3000
1991	Pickup	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	Land Cruiser	3F-E	90	11.5	3000
1992	Pickup	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	Land Cruiser	3F-E	90	11.5	3000
1993	Pickup	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	T100	3VZ-E	90	11.5	3500
	Land Cruiser	1FZ-FE	90	11.5	3000
1994	Pickup	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	T100	3RZ-FE	90	11.5	3500
		3VZ-E	90	11.5	①
	Land Cruiser	1FZ-FE	90	11.5	3000
1995	Pickup	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	4Runner	22R-E	90	11.5	①
		3VZ-E	90	11.5	①
	Tacoma	2RZ-FE	90	11.5	3000
		3RZ-FE	90	11.5	3000
		5VZ-FE	90	11.5	3000
	T100	3RZ-FE	90	11.5	3500
		5VZ-FE	90	11.5	3500
	Land Cruiser	1FZ-FE	90	11.5	3000

86822117

STARTER SPECIFICATIONS

Year	Model	Engine	No-Load Test		
			Max. Amps	Max. Volts	RPM
1996	4Runner	3RZ-FE	90	11.5	①
		5VZ-FE	90	11.5	①
	Tacoma	2RZ-FE	90	11.5	①
		3RZ-FE	90	11.5	①
		5VZ-FE	90	11.5	①
	T100	3RZ-FE	90	11.5	3500
		5VZ-FE	90	11.5	3500
	Land Cruiser	1FZ-FE	90	11.5	3000

① 1.0 kw-3000 rpm
1.4, 1.6 kw-3500 rpm
2.0 kw-2500 rpm

86822118

SENDING UNITS AND SENSORS

Engine Coolant Temperature Sensor

OPERATION

▸ See Figure 58

The engine coolant temperature sensor is usually located on the thermostat housing. This sensor controls the readings of the coolant temperature gauge in your vehicle when the ignition switch is **ON**.

There is a needle that shows the temperature area of the engine. If the needle points in the red zone or higher (this is overheating), you should pull to the side of the road and turn your engine **OFF** immediately and allow it to cool.

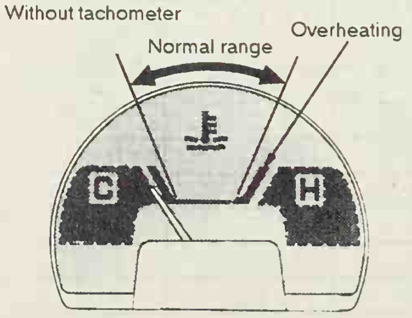

Fig. 58 A common engine coolant temperature gauge found on Toyota trucks

REMOVAL & INSTALLATION

1. Drain the coolant from the vehicle.
2. Disconnect the engine wiring protector from the brackets.
3. Disconnect the sensor wire.
4. Using a 19mm deep socket, remove the sensor and gasket.

To install:

5. Apply a thin coat of Loctite® or equivalent to the switch. By hand, carefully thread the switch into the engine. If resistance is felt at all, remove the switch and inspect the threads for any damage. Continue to install the switch. Once installed tighten to 14 ft. lbs. (20 Nm).
6. Connect the sensor wiring.
7. Install the engine wire protector to the brackets.
8. Refill the coolant. Start the engine and check for leaks.

Oil Pressure Light/Gauge Sender

OPERATION

▸ See Figure 59

The oil pressure sender/switch controls the gauge or idiot light operation in you vehicle while the engine is **ON**. The gauge will fluctuate during engine operation. If the pressure should stay below the normal range, you should pull to the side of the road and turn your engine **OFF** immediately. Check your oil level of the vehicle on level ground, if it is low, fill to the proper level. Start the engine and recheck after a few minutes. Oil pressure may not build up when the level is too low.

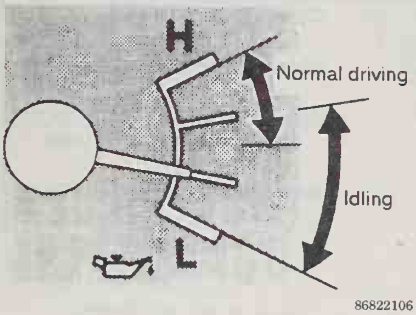
H
Normal driving
Idling
L
86822106

Fig. 59 A common oil pressure gauge found on Toyota trucks

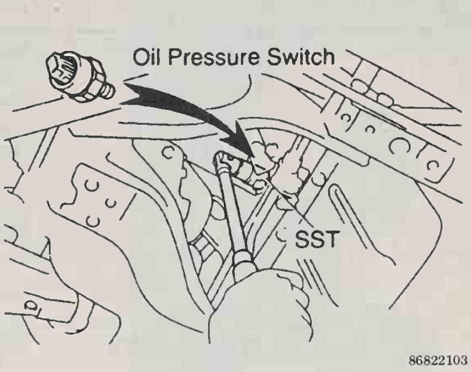
Oil Pressure Switch
SST
86822103

Fig. 60 A special socket is used to remove the switch

REMOVAL & INSTALLATION

▸ See Figures 60 and 61

1. If equipped, remove the lower engine splash shield.
2. Using special tool 09816-33010 or an equivalent oil pressure switch socket, remove the switch.

To install:

3. Apply a thin coat of Loctite® or equivalent to the switch. By hand, carefully thread the switch into the engine. If resistance is felt at all, remove the switch and inspect the threads for any damage. Continue to install the switch. Once installed tighten to 11 ft. lbs. (15 Nm).
4. If removed, install the engine splash shield.
5. Start the engine and inspect for leaks.

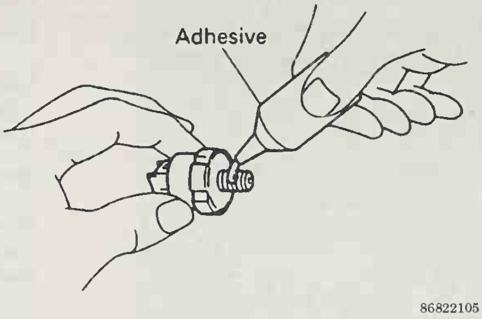
Adhesive
86822105

Fig. 61 Apply a thin coat of adhesive such as Loctite® or an equivalent to the switch prior to installation

Troubleshooting Basic Starting System Problems

Problem	Cause	Solution
Starter motor rotates engine slowly	• Battery charge low or battery defective • Defective circuit between battery and starter motor • Low load current • High load current	• Charge or replace battery • Clean and tighten, or replace cables • Bench-test starter motor. Inspect for worn brushes and weak brush springs. • Bench-test starter motor. Check engine for friction, drag or coolant in cylinders. Check ring gear-to-pinion gear clearance.
Starter motor will not rotate engine	• Battery charge low or battery defective • Faulty solenoid • Damaged drive pinion gear or ring gear • Starter motor engagement weak • Starter motor rotates slowly with high load current • Engine seized	• Charge or replace battery • Check solenoid ground. Repair or replace as necessary. • Replace damaged gear(s) • Bench-test starter motor • Inspect drive yoke pull-down and point gap, check for worn end bushings, check ring gear clearance • Repair engine
Starter motor drive will not engage (solenoid known to be good)	• Defective contact point assembly • Inadequate contact point assembly ground • Defective hold-in coil	• Repair or replace contact point assembly • Repair connection at ground screw • Replace field winding assembly
Starter motor drive will not disengage	• Starter motor loose on flywheel housing • Worn drive end busing • Damaged ring gear teeth • Drive yoke return spring broken or missing	• Tighten mounting bolts • Replace bushing • Replace ring gear or driveplate • Replace spring
Starter motor drive disengages prematurely	• Weak drive assembly thrust spring • Hold-in coil defective	• Replace drive mechanism • Replace field winding assembly
Low load current	• Worn brushes • Weak brush springs	• Replace brushes • Replace springs

tccs2c01

3

ENGINE AND ENGINE OVERHAUL

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ENGINE MECHANICAL

General Information

The piston engine is a metal block containing a series of round chambers or cylinders. These chambers may be arranged in line or in a V; hence, the description of an engine as an inline 4 or 6 or a V-6. The upper part of the engine block is usually an iron or aluminum-alloy casting. The casting forms outer walls around the cylinders with hollow areas in between, through which coolant circulates. The lower block provides a number of rigid mounting points for the crankshaft and its bearings. The lower block is referred to as the crankcase.

The crankshaft is a long, steel shaft mounted at the bottom of the engine and free to turn in its mounts. The mounting points (generally four to seven) and the bearings for the crankshaft are called main bearings. The crankshaft is the shaft which is made to turn through the function of the engine; this motion is then passed into the transmission/transaxle and on to the drive wheels.

Attached to the crankshaft are the connecting rods which run up to the pistons within the cylinders. As the air/fuel mixture explodes within the tightly sealed cylinder, the piston is forced downward. This motion is transferred through the connecting rod to the crankshaft and the shaft turns. As one piston finishes its power stroke, its next upward journey forces the burnt gasses out of the cylinder through the now-open exhaust valve. By the top of the stroke, the exhaust valve has closed and the intake valve has begun to open, allowing the fresh air/fuel charge to be sucked into the cylinder by the downward stroke of the piston. The intake valve closes, the piston once again comes back up and compresses the charge in the closed cylinder. At the top (approximately) of this stroke the spark plug fires, the charge explodes and another power stroke takes place. If you count the piston motions in between power strokes, you'll see why automotive engines are called four-stroke or four-cycle engines.

While one cylinder is performing this cycle, all the others are also contributing; but in different timing. Obviously, all the cylinders cannot fire at once or the power flow would not be steady. As any one cylinder is on its power stroke, another is on its exhaust stroke, another on intake and another on compression. These constant power pulses keep the crank turning; a large round flywheel attached to the end of the crankshaft provides a stable mass to smooth out the rotation.

At the top of the engine, the cylinder head(s) provide tight covers for the cylinders. They contain machined chambers into which the fuel charge is forced as the piston reaches the top of its travel. These combustion chambers contain at least one intake and one exhaust valve which are opened and closed through the action of the camshaft. The spark plugs are screwed into the cylinder head so that the tips of the plugs protrude into the chamber.

Since the timing of the valve action (opening and closing) is critical to the combustion process, the camshaft is driven by a belt or chain. The valves are operated either by pushrods (called overhead valves the valves are above the cam) or by the direct action of the cam pushing on the valves (overhead cam). Toyota trucks with either the 4 cylinder or V-6 engines use overhead cam (OHC) engines. The Land Cruiser 3F-E engine is a pushrod or overhead valve engine.

Lubricating oil is stored in a pan or sump at the bottom of the engine. It is force fed to all the parts of the engine by the oil pump which may be driven by either the crank or the camshaft. The oil lubricates the entire engine by travelling through passages in the block and head. Additionally, the circulation of the oil provides 25-40% of the engine cooling.

If all this seems very complicated, keep in mind that the sole purpose of any motor gas, diesel, electric, solar is to turn a shaft. The motion of the shaft is then harnessed to perform a task such as pumping water, moving the vehicle, etc. Due to the constantly changing operating conditions found in a motor vehicle, accomplishing this shaft-turning in an automotive engine requires many supporting systems such as fuel delivery, exhaust handling, lubrication, cooling, starting, etc. Operation of these systems involve principles of mechanics, vacuum, electronics, etc. Being able to identify a problem by what system is involved will allow you to begin accurate diagnosis of the symptoms and causes.

Engine Overhaul Tips

Most engine overhaul procedures are fairly standard. In addition to specific parts replacement procedures and specifications for your individual engine, this section also is a guide to acceptable rebuilding procedures. Examples of standard rebuilding practice are shown and should be used along with specific details concerning your particular engine.

Competent and accurate machine shop services will ensure maximum performance, reliability and engine life. In most instances it is more profitable for the do-it-yourself mechanic to remove, clean and inspect the component, buy the necessary parts and deliver these to a shop for actual machine work.

On the other hand, much of the rebuilding work (crankshaft, block, bearings, piston rods, and other components) is well within the scope of the do-it-yourself mechanic's tools and abilities. You will have to decide for yourself the depth of involvement you desire in an engine repair or rebuild.

TOOLS

The tools required for an engine overhaul or parts replacement will depend on the depth of your involvement. With a few exceptions, they will be the tools found in a mechanic's tool kit (see Section 1 of this manual). More in-depth work will require some or all of the following:

- a dial indicator (reading in thousandths) mounted on a universal base
- micrometers and telescope gauges
- jaw and screw-type pullers
- scraper
- valve spring compressor
- ring groove cleaner
- piston ring expander and compressor

- ridge reamer
- cylinder hone or glaze breaker
- Plastigage®
- engine stand

The use of most of these tools is illustrated in this section. Many can be rented for a one-time use from a local parts jobber or tool supply house specializing in automotive work.

Occasionally, the use of special tools is called for. See the information on Special Tools and the Safety Notice in the front of this book before substituting another tool.

INSPECTION TECHNIQUES

Procedures and specifications are given in this section for inspecting, cleaning and assessing the wear limits of most major components. Other procedures such as Magnaflux® and Zyglo® can be used to locate material flaws and stress cracks. Magnaflux® is a magnetic process applicable only to ferrous materials. The Zyglo® process coats the material with a fluorescent dye penetrant and can be used on any material. Checking for suspected surface cracks can be more readily made using spot check dye. The dye is sprayed onto the suspected area, wiped off and the area sprayed with a developer. Cracks will show up brightly.

OVERHAUL TIPS

Aluminum has become extremely popular for use in engines, due to its low weight. Observe the following precautions when handling aluminum parts:

- Never hot tank aluminum parts (the caustic hot tank solution will eat the aluminum.
- Remove all aluminum parts (identification tag, etc.) from engine parts prior to the tanking.
- Always coat threads lightly with engine oil or anti-seize compounds before installation, to prevent seizure.
- Never overtighten bolts or spark plugs especially in aluminum threads.

Stripped threads in any component can be repaired using any of several commercial repair kits (Heli-Coil®, Microdot®, Keenserts®, etc.).

When assembling the engine, any parts that will be exposed to frictional contact, the parts must be prelubed to provide lubrication at initial start-up. Any product specifically formulated for this purpose can be used, but engine oil is not recommended as a prelube in most cases.

When semi-permanent (locked, but removable) installation of bolts or nuts is desired, threads should be cleaned and coated with Loctite® or other similar, commercial non-hardening sealant.

REAPAIRING DAMAGED THREADS

◗ See Figures 1, 2, 3, 4 and 5

Several methods of repairing damaged threads are available. Heli-Coil® (shown here), Keenserts® and Microdot® are among the most widely used. All involve basically the same principle — drilling out stripped threads, tapping the hole and installing a prewound insert — making welding, plugging and oversize fasteners unnecessary.

Two types of thread repair inserts are usually supplied: a standard type for most inch coarse, inch fine, metric course and metric fine thread sizes and a spark lug type to fit most spark plug port sizes. Consult the individual manufacturer's catalog to determine exact applications. Typical thread repair kits will contain a selection of prewound threaded inserts, a tap (corresponding to the outside diameter threads of the insert) and an installation tool. Spark plug inserts usually differ because they require a tap equipped with pilot threads and a combined reamer/tap section. Most manufacturers also supply blister-packed thread repair inserts separately in addition to a master kit containing a variety of taps and inserts plus installation tools.

Before attempting to repair a threaded hole, remove any snapped, broken or damaged bolts or studs. Penetrating oil can be used to free frozen threads. The offending item can be removed with locking pliers or using a screw/stud extractor. After the hole is clear, the thread can be repaired, as shown

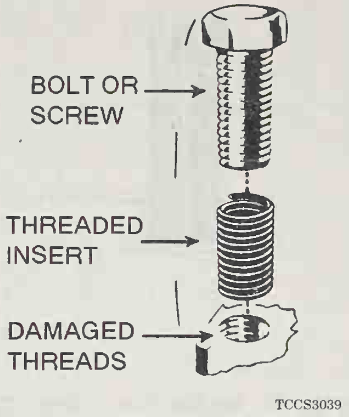


Fig. 1 Damaged bolt hole threads can be replaced with thread repair inserts

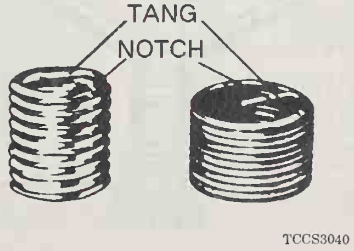
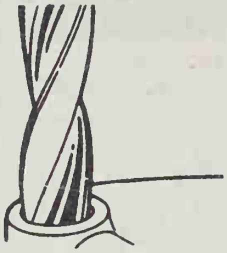
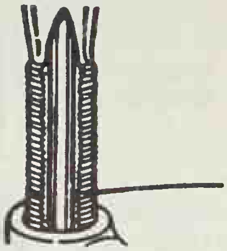


Fig. 2 Standard thread repair insert (left), and spark plug thread insert



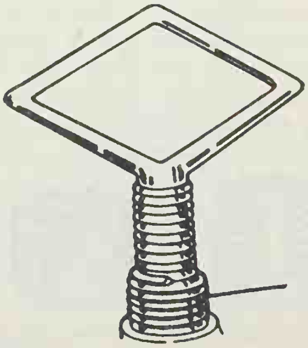
TCCS3041

Fig. 3 Drill out the damaged threads with the specified drill. Be sure to drill completely through the hole or to the bottom of a blind hole



TCCS3042

Fig. 4 Using the kit, tap the hole in order to receive the thread insert. Keep the tap well oiled and back it out frequently to avoid clogging the threads



TCCS3043

Fig. 5 Screw the threaded insert onto the installer tool until the tang engages the slot. Thread the insert into the hole until it is ¼ or ½ turn below the top surface, then remove the tool and break off the tang using a punch

in the series of accompanying illustrations and in the kit manufacturer's instructions.

Compression Testing

➧ See Figure 6

A noticeable lack of engine power, excessive oil consumption and/or poor fuel mileage measured over an extended period are all indicators of internal engine wear. Worn piston rings, scored or worn cylinder bores, leaking head gaskets, sticking or burnt valves and worn valve seats are all possible culprits here. A check of each cylinder's compression will help you locate the problems.

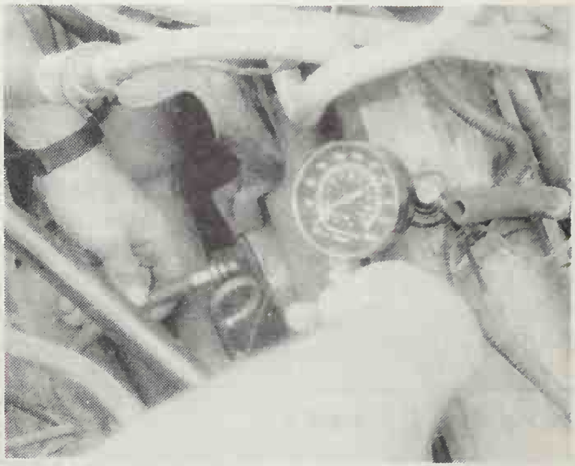
As mentioned in the Tools and Equipment part of Section 1, a screw-in type compression gauge is more accurate that the type you simply hold against the spark plug hole, although it takes slightly longer to use. It's worth it to obtain a more accurate reading. Follow the procedures below.

1. Warm up the engine to normal operating temperature.
2. Remove all the spark plugs.
3. Disconnect the high tension lead (coil wire) from the ignition coil.
4. Fully open the throttle either by operating the carburetor throttle linkage by hand or by having an assistant floor the accelerator pedal.
5. Screw the compression gauge into the No.1 spark plug hole until the fitting is snug.

✻✻WARNING

Be careful not to crossthread the plug hole. On aluminum cylinder heads use extra care, as the threads in these heads are easily ruined.

6. Ask an assistant to depress the accelerator pedal fully on both carbureted and fuel injected vehicles. Then, while you read the compression gauge, ask the assistant to crank the engine two or three times in short bursts using the ignition switch.
7. Read the compression gauge at the end of each series of cranks, and record the highest of these readings. Repeat



TCCS3801

Fig. 6 A screw-in type compression gauge is more accurate and easier to use without an assistant

this procedure for each of the engine's cylinders. As a general rule, new motors will have compression on the order of 150-170 psi (1034-1172 kPa). This number will decrease with age and wear. The number of pounds of pressure that your test shows is not as important as the evenness between all the cylinders. Many engines run very well with all cylinders at 105 psi (724 kPa). The lower number simply shows a general deterioration internally. This motor probably burns a little oil and may be a bit harder to start, but, based on these numbers, doesn't warrant an engine tear-down yet. Compare the highest reading of all the cylinders. Any variation of more than 10% should be considered a sign of potential trouble. For example, on a 4 cylinder engine, if your compression readings for cylinders 1 through 4 were: 135 psi (930 kPa), 125 psi (861 kPa), 90 psi (620 kPa) and 125 psi (861 kPa), it would be fair to say that cylinder number three is not working efficiently and is almost certainly the cause of your oil burning, rough idle or poor fuel mileage.

8. If a cylinder is unusually low, pour a tablespoon of clean engine oil into the cylinder through the spark plug hole and repeat the compression test. If the compression comes up after adding the oil, it appears that the cylinder's piston rings or bore are damaged or worn. (The oil sealed some of the leakage.) If the pressure remains low, the valves may not be seating properly (a valve job is needed), or the head gasket may be blown near that cylinder. If compression in any two adjacent cylinders is low, and if the addition of oil doesn't help the compression, there is leakage past the head gasket. Oil and coolant in the combustion chamber can result from this problem. There may also be evidence of water droplets on the engine oil dipstick when a head gasket has blown.

GENERAL ENGINE SPECIFICATIONS

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Fuel System Type	Net Horsepower @ rpm	Net Torque @ rpm (ft. lbs.)	Bore x Stroke (in.)	Com-pression Ratio	Oil Pressure @ rpm
1989	22R	2.4 (2366)	2 BBL	96@4800	129@2800	3.62x3.50	9.3:1	36-71@4000
	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.350	9.3:1	36-71@4000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3F-E	4.0 (3956)	EFI	154@4000	220@3000	3.70x3.74	8.1:1	36-71@4000
1990	22R	2.4 (2366)	2 BBL	96@4800	129@2800	3.62x3.50	9.3:1	36-71@3000
	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3F-E	4.0 (3956)	EFI	154@4000	220@3000	3.70x3.74	8.1:1	36-71@4000
1991	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3F-E	4.0 (3956)	EFI	154@4000	220@3000	3.70x3.74	8.1:1	36-71@4000
1992	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3F-E	4.0 (3956)	EFI	154@4000	220@3000	3.70x3.74	8.1:1	36-71@4000
1993	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3VZ-FE	3.0 (2952)	EFI	185@5200	195@4400	3.44x3.23	9.6:1	4.3 ①
	1FZ-FE	4.5 (4477)	EFI	212@4600	275@3200	3.94x3.74	9.0:1	36-71@3000
1994	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	3RZ-FE	2.7 (2693)	EFI	150@4800	177@4000	3.74x3.74	9.5:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@4000
	3VZ-FE	3.0 (2952)	EFI	185@5200	195@4400	3.44x3.23	9.6:1	4.3 ①
	1FZ-FE	4.5 (4477)	EFI	212@4600	275@3200	3.94x3.64	9.0:1	36-71@3000
1995	22R-E	2.4 (2366)	EFI	116@4800	140@2800	3.62x3.50	9.3:1	36-71@3000
	2RZ-FE	2.4 (2438)	EFI	142@5000	160@4000	3.74x3.38	9.5:1	36-71@3000
	3RZ-FE	2.7 (2693)	EFI	150@4800	177@4000	3.74x3.74	9.5:1	36-71@3000
	3VZ-E	3.0 (2959)	EFI	150@4800	180@3400	3.44x3.23	9.0:1	36-71@3000
	5VZ-FE	3.4 (3378)	EFI	190@4800	220@3400	3.68x3.23	9.6:1	4.3 ①
	1FZ-FE	4.5 (4477)	EFI	212@4600	275@3200	3.94x3.64	9.0:1	36-71@3000
1996	2RZ-FE	2.4 (2438)	EFI	142@5000	160@4000	3.74x3.38	9.5:1	36-71@3000
	3RZ-FE	2.7 (2693)	EFI	150@4800	177@4000	3.74x3.74	9.5:1	36-71@3000
	5VZ-FE	3.4 (3378)	EFI	190@4800	220@3400	3.68x3.23	9.6:1	4.3 ①
	1FZ-FE	4.5 (4477)	EFI	212@4600	275@3200	3.94x3.64	9.0:1	36-71@3000

1 At idle
BBL - Barrel carburetor
EFI - Electronic fuel injection

86823002

VALVE SPECIFICATIONS

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Seat Angle (deg.)	Face Angle (deg.)	Spring Test Pressure (lbs. @ in.)	Spring Installed Height (in.)	Stem-to-Guide Clearance (in.)		Stem Diameter (in.)	
							Intake	Exhaust	Intake	Exhaust
1989	22R	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3F-E	4.0 (3956)	45	44.5	71.6	1.693	0.0012-0.0024	0.0016-0.0028	0.3140	0.3137
1990	22R	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3F-E	4.0 (3956)	45	44.5	71.6	1.593	0.0012-0.0024	0.0016-0.0028	0.3140	0.3137
1991	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3F-E	4.0 (3956)	45	44.5	71.6	1.693	0.0012-0.0024	0.0016-0.0028	0.3140	0.3137
1992	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3F-E	4.0 (3956)	45	44.5	71.6	1.693	0.0012-0.0024	0.0016-0.0028	0.3140	0.3137
1993	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	1FZ-FE	4.5 (4477)	45	44.5	53.4	1.437	0.0010-0.0024	0.0012-0.0026	0.2744-0.2750	0.2742-0.2748
1994	22R-E	2.4 (2366)	45 ①	44.5	66.1	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3RZ-FE	2.7 (2693)	45 ①	44.5	57-63	1.406	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	3VZ-FE	3.0 (2952)	45	44.5	38-42	1.311	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	1FZ-FE	4.5 (4477)	45	44.5	53.4	1.437	0.0010-0.0024	0.0012-0.0026	0.2744-0.2750	0.2742-0.2748

86823003

VALVE SPECIFICATIONS

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Seat Angle (deg.)	Face Angle (deg.)	Spring Test Pressure (lbs. @ in.)	Spring Installed Height (in.)	Stem-to-Guide Clearance (in.)		Stem Diameter (in.)	
							Intake	Exhaust	Intake	Exhaust
1995	22R-E	2.4 (2366)	45 ①	44.5	66.1@1.594	1.594	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	2RZ-FE	2.4 (2438)	45 ①	44.5	40-46@1.406	1.406	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	3RZ-FE	2.7 (2693)	45 ①	44.5	57-63@1.406	1.406	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	3VZ-E	3.0 (2959)	45 ①	44.5	54-57@1.575	1.575	0.0010-0.0024	0.0012-0.0026	0.3138-0.3144	0.3136-0.3142
	5VZ-FE	3.4 (3378)	45	44.5	41.9-46.3@1.311	1.311	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	1FZ-FE	4.5 (4477)	45	44.5	53.4@1.437	1.437	0.0010-0.0024	0.0012-0.0026	0.2744-0.2750	0.2742-0.2748
1996	2RZ-FE	2.4 (2438)	45 ①	44.5	40-46@1.406	1.406	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	3RZ-FE	2.7 (2693)	45 ①	44.5	57-63@1.406	1.406	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	5VZ-FE	3.4 (3378)	45	44.5	41.9-46.3@1.311	1.311	0.0010-0.0024	0.0012-0.0026	0.2350-0.2356	0.2348-0.2354
	1FZ-FE	4.5 (4477)	45	44.5	53.4@1.437	1.437	0.0010-0.0024	0.0012-0.0026	0.2744-0.2750	0.2742-0.2748

[1] Blend seat with 30 and 60 degree cutters to center the 45 degree portion on valve face

86823004

CAMSHAFT SPECIFICATIONS

All measurements given in inches.

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Journal Diameter					Elevation		Bearing Clearance	Camshaft End-Play
			1	2	3	4	5	In.	Ex.		
1989	22R	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	1.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	3F-E	4.0 (3956)	1.8880-1.8888	1.8289-1.8297	1.7699-1.7707	1.7108-1.7116	NA	1.5102-1.5142	1.5059-1.5098	0.0010-0.0030	0.0079-0.0103
1990	22R	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	1.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	3F-E	4.0 (3956)	1.8880-1.8888	1.8289-1.8297	1.7699-1.7707	1.7108 1.7116	NA	1.5102-1.5142	1.5059-1.5098	0.0010-0.0030	0.0079-0.0103
1991	22R-E	2.4 (2393)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.5102-1.5142	1.5059-1.5098	0.0010-0.0030	0.0079-0.0103
	3F-E	4.0 (3956)	1.8880-1.8888	1.8289-1.8297	1.7699-1.7707	1.7108-1.7116	NA	1.5102-1.5142	1.5059-1.5098	0.0010-0.0030	0.0079-0.0103
1992	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	1.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	3F-E	4.0 (3956)	1.8880-1.8888	1.8289-1.8297	1.7699-1.7707	1.7108-1.7116	NA	1.5102-1.5142	1.5059-1.5098	0.0010-0.0030	0.0079-0.0103
1993	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	1.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	3VZ-FE	3.0 (2952)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	1.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	1FZ-FE	4.5 (4477)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	NA	1.9925-1.9965	1.9925-1.9965	0.0010-0.0024	0.0012-0.0031
1994	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	3RZ-FE	2.7 (2693)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	NA	1.7839-1.7878	1.7740-1.7779	0.0010-0.0031	0.0016-0.0047

86823005

CAMSHAFT SPECIFICATIONS

All measurements given in inches.

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Journal Diameter 1	2	3	4	5	Elevation In.	Ex.	Bearing Clearance	Camshaft End-Play
1994	3VZ-E	3.0 (2959)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	0.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	3VZ-FE	3.0 (2952)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6598-1.6638	0.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	1FZ-FE	4.5 (4477)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	NA	1.9925-1.9965	1.9925-1.9965	0.0010-0.0024	0.0012-0.0031
1995	22R-E	2.4 (2366)	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	1.2984-1.2992	NA	1.6783-1.6819	1.6807-1.6842	0.0004-0.0024	0.0031-0.0071
	2RZ-FE	2.4 (2438)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.7839-1.7878	1.7740-1.7779	0.0010-0.0024	0.0016-0.0037
	3RZ-FE	2.7 (2693)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.7839-1.7878	1.7740-1.7779	0.0010-0.0031	0.0016-0.0047
	5VZ-FE	3.4 (3378)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6657-1.6697	0.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	1FZ-FE	4.5 (4477)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	NA	1.9925-1.9965	1.9925-1.9965	0.0010-0.0024	0.0012-0.0031
1996	2RZ-FE	2.4 (2438)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.7839-1.7878	1.7740-1.7779	0.0010-0.0024	0.0016-0.0037
	3RZ-FE	2.7 (2693)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.7839-1.7878	1.7740-1.7779	0.0010-0.0031	0.0016-0.0047
	5VZ-FE	3.4 (3378)	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	1.0610-1.0616	NA	1.6657-1.6697	0.6520-1.6559	0.0014-0.0028	0.0013-0.0031
	1FZ-FE	4.5 (4477)	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	1.0614-1.0620	NA	1.9925-1.9965	1.9925-1.9965	0.0010-0.0024	0.0012-0.0031

NA - Not Available

86823006

CRANKSHAFT AND CONNECTING ROD SPECIFICATIONS

All measurements are given in inches.

			Crankshaft				Connecting Rod		
Year	Engine ID/VIN	Engine Displacement Liters (cc)	Main Brg. Journal Dia.	Main Brg. Oil Clearance	Shaft End-play	Thrust on No.	Crank Rod Clearance	Oil Clearance	Side Clearance
1989	22R	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3F-E	4.0 (3956)	①	0.0008-0.0017	0.0024-0.0063	3	2.1252-2.1260	0.0008-0.0024	0.0043-0.0091
1990	22R	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3F-E	4.0 (3956)	①	0.0008-0.0017	0.0024-0.0063	3	2.1252-2.1260	0.0008-0.0024	0.0043-0.0091
1991	22R-E	2.4 (2366)	2,3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3F-E	4.0 (3956)	①	0.0008-0.0017	0.0024-0.0063	3	2.1252-2.1260	0.0008-0.0024	0.0043-0.0091
1992	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3F-E	4.0 (3956)	①	0.0008-0.0017	0.0024-0.0063	3	2.1252-2.1260	0.0008-0.0024	0.0043-0.0091
1993	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3VZ-E	3.0 (2959)	2..5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	1FZ-FE	4.5 (4477)	2.7158-2.7165	0.0016-0.0032	0.0008-0.0087	3	②	0.0013-0.0020	0.0063-0.0103
1994	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	3RZ-FE	2.7 (2693)	2.3617-2.3622	0.0009-0.0019	0.0008-0.0087	3	2.0861-2.0866	0.0012-0.0023	0.0063-0.0123
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	1FZ-FE	4.5 (4477)	2.7158-2.7165	0.0016-0.0032	0.0008-0.0087	3	②	0.0013-0.0020	0.0063-0.0103

86823010

CRANKSHAFT AND CONNECTING ROD SPECIFICATIONS

All measurements are given in inches.

			Crankshaft				Connecting Rod		
Year	Engine ID/VIN	Engine Displacement Liters (cc)	Main Brg. Journal Dia.	Main Brg. Oil Clearance	Shaft End-play	Thrust on No.	Crank Rod Clearance	Oil Clearance	Side Clearance
1995	22R-E	2.4 (2366)	2.3616-2.3622	0.0010-0.0022	0.0008-0.0087	3	2.0861-2.0866	0.0010-0.0022	0.0008-0.0087
	2RZ-FE	2.4 (2438)	③	④	0.0008-0.0087	3	⑤	0.0012-0.0022	0.0063-0.0123
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3RZ-FE	2.7 (2693)	③	④	0.0008-0.0087	3	⑤	0.0012-0.0022	0.0063-0.0123
	5VZ-FE	3.4 (3378)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0087	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	1FZ-FE	4.5 (4477)	2.7158-2.7165	0.0016-0.0032	0.0008-0.0087	3	②	0.0013-0.0020	0.0063-0.0103
1996	2RZ-FE	2.4 (2438)	③	④	0.0008-0.0087	3	⑤	0.0012-0.0022	0.0063-0.0123
	3VZ-E	3.0 (2959)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0098	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	3RZ-FE	2.7 (2693)	③	④	0.0008-0.0087	3	⑤	0.0012-0.0022	0.0063-0.0123
	5VZ-FE	3.4 (3378)	2.5195-2.5197	0.0009-0.0017	0.0008-0.0087	3	2.1648-2.1654	0.0009-0.0021	0.0059-0.0130
	1FZ-FE	4.5 (4477)	2.7158-2.7165	0.0016-0.0032	0.0008-0.0087	3	②	0.0013-0.0020	0.0063-0.0103

1 No. 1: 2.6367-2.6376
No. 2: 2.6957-2.6967
No. 3: 2.7548-2.7557
No. 4: 2.8139-2.8148

2 There are five sizes of standard connecting rod bearings marked 2, 3, 4, 5 and 6 accordingly.
Replace with one having the same number (number imprinted on outside of bearing end).
If the number of bearing cannot be determined, select correct bearing by adding together the numbers imprinted on connecting rod and crankshaft, then selecting the bearing with the same number as the total.
EXAMPLE: Connecting rod 3 + Crankshaft 1=4. Use bearing 4.

3 No. 3: 2.2615-2.3620
Others: 2.3617-2.3622

4 No. 3: 0.0012-0.0022
All others: 0.0009-0.0019

5 Mark 4: 2.2047-2.2050
Mark 5: 2.2050-2.2052
Mark 6: 2.2052-2.2054

86823011

PISTON AND RING SPECIFICATIONS

All measurements are given in inches.

				Ring Gap			Ring Side Clearance		
Year	Engine ID/VIN	Engine Displacement Liters (cc)	Piston Clearance	Top Compression	Bottom Compression	Oil Control	Top Compression	Bottom Compression	Oil Control
1989	22R	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0090-0.0130	0.0150-0.0190	0.0060-0.0160	0.0012-0.0028	0.0012-0.0028	SNUG
	3F-E	4.0 (3956)	0.0011-0.0019	0.0079-0.0165	0.0197-0.0283	0.0079-0.0323	0.0012-0.0028	0.0020-0.0035	SNUG
1990	22R	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0091-0.0327	0.0150-0.0366	0.0059-0.0354	0.0012-0.0028	0.0012-0.0028	0.0012-0.0028
	3F-E	4.0 (3956)	0.0011-0.0019	0.0079-0.0165	0.0197-0.0283	0.0079-0.0323	0.0012-0.0028	0.0020-0.0035	SNUG
1991	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0091-0.0327	0.0150-0.0366	0.0059-0.0354	0.0012-0.0028	0.0012-0.0028	SNUG
	3F-E	4.0 (3956)	0.0011-0.0019	0.0079-0.0165	0.0197-0.0283	0.0079-0.0323	0.0012-0.0028	0.0020-0.0035	SNUG
1992	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0091-0.0327	0.0150-0.0366	0.0059-0.0354	0.0012-0.0028	0.0012-0.0028	0.0012-0.0028
	3F-E	4.0 (3956)	0.0011-0.0019	0.0079-0.0165	0.0197-0.0283	0.0079-0.0323	0.0012-0.0028	0.0020-0.0035	SNUG
1993	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0091-0.0327	0.0150-0.0366	0.0059-0.0354	0.0012-0.0028	0.0012-0.0028	SNUG
	3VZ-FE	3.0 (2952)	0.0051-0.0059	0.0110-0.0197	0.0150-0.0236	0.0059-0.0234	0.0004-0.0031	0.0012-0.0028	SNUG
	1FZ-FE	4.5 (4477)	0.0016-0.0024	0.0118-0.0205	0.0177-0.0264	0.0059-0.0205	0.0016-0.0031	0.0012-0.0028	SNUG
1994	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	3RZ-FE	2.7 (2693)	0.0019-0.0024	0.0118-0.0157	0.0157-0.0194	0.0157-0.0194	0.0008-0.0028	0.0012-0.0028	0.0019-0.0024
	3VZ-E	3.0 (2959)	0.0031-0.0039	0.0091-0.0327	0.0150-0.0366	0.0059-0.0354	0.0012-0.0028	0.0012-0.0028	0.0012-0.0028
	3VZ-FE	3.0 (2952)	0.0051-0.0059	0.0110-0.0197	0.0150-0.0236	0.0059-0.0234	0.0004-0.0031	0.0012-0.0028	SNUG
	1FZ-FE	4.5 (4477)	0.0016-0.0024	0.0118-0.0205	0.0177-0.0264	0.0059-0.0205	0.0016-0.0031	0.0012-0.0028	SNUG

86823007

PISTON AND RING SPECIFICATIONS

All measurements are given in inches.

				Ring Gap			Ring Side Clearance		
Year	Engine ID/VIN	Engine Displacement Liters (cc)	Piston Clearance	Top Compression	Bottom Compression	Oil Control	Top Compression	Bottom Compression	Oil Control
1995	22R-E	2.4 (2366)	0.0008-0.0016	0.0098-0.0185	0.0236-0.0323	0.0079-0.0224	0.0012-0.0028	0.0012-0.0028	SNUG
	2RZ-FE	2.4 (2438)	0.0022-0.0031	0.0118-0.0157	0.0157-0.0197	0.0051-0.0150	0.0008-0.0028	0.0012-0.0028	SNUG
	3RZ-FE	2.7 (2693)	0.0019-0.0024	0.0118-0.0157	0.0157-0.0194	0.0051-0.0150	0.0008-0.0028	0.0012-0.0028	0.0019-0.0024
	5VZ-FE	3.4 (3378)	0.0053-0.0060	0.0118-0.0197	0.0157-0.0236	0.0059-0.0217	0.0016-0.0031	0.0012-0.0028	0.0012-0.0028
	1FZ-FE	4.5 (4477)	0.0016-0.0024	0.0118-0.0205	0.0177-0.0264	0.0059-0.0205	0.0016-0.0031	0.0012-0.0028	SNUG
1996	2RZ-FE	2.4 (2438)	0.0022-0.0031	0.0118-0.0157	0.0157-0.0197	0.0051-0.0150	0.0008-0.0028	0.0012-0.0028	SNUG
	3RZ-FE	2.7 (2693)	0.0019-0.0024	0.0118-0.0157	0.0157-0.0194	0.0051-0.0150	0.0008-0.0028	0.0012-0.0028	0.0019-0.0024
	5VZ-FE	3.4 (3378)	0.0053-0.0060	0.0118-0.0197	0.0157-0.0236	0.0059-0.0217	0.0016-0.0031	0.0012-0.0028	0.0012-0.0028
	1FZ-FE	4.5 (4477)	0.0016-0.0024	0.0118-0.0205	0.0177-0.0264	0.0059-0.0205	0.0016-0.0031	0.0012-0.0028	SNUG

86823008

TORQUE SPECIFICATIONS

All readings in ft. lbs.

Year	Engine ID/VIN	Engine Displacement Liters (cc)	Cylinder Head Bolts	Main Bearing Bolts	Rod Bearing Bolts	Crankshaft Damper Bolts	Flywheel Bolts	Manifold		Spark Plugs	Lug Nut
								Intake	Exhaust		
1989	22R	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3VZ-E	3.0 (2959)	③	②	①	176-186	63-67	11-15	25-33	11-15	76
	3F-E	4.0 (3956)	87-93	④	40-46	247-259	60-68	⑤	⑤	11-15	116
1990	22R	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3VZ-E	3.0 (2959)	③	②	①	176-186	63-67	11-15	25-33	11-15	76
	3F-E	4.0 (3956)	87-93	④	40-46	247-259	60-68	⑤	⑤	11-15	116
1991	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3VZ-E	3.0 (2959)	③	②	①	176-186	63-67	11-15	252-33	11-15	76
	3F-E	4.0 (3956)	87-93	④	40-46	247-259	60-68	⑤	⑤	11-15	116
1992	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3VZ-E	3.0 (2959)	③	①	②	176-186	63-67	11-15	25-33	11-15	76
	3F-E	4.0 (3956)	87-93	④	40-46	247-259	60-68	⑤	⑤	11-15	116
1993	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3VZ-E	3.0 (2959)	③	①	②	176-186	63-67	11-15	25-33	11-15	76
	3VZ-FE	3.0 (2952)	⑥	①	②	181	61	13	29	13	76
	1FZ-FE	4.5 (4477)	⑦	⑧	⑧	304	-	15	29	15	108
1994	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	3RZ-FE	2.7 (2693)	⑨	⑨	⑪	192	①	22	36	14	76
	3VZ-E	3.0 (2959)	③	①	②	176-186	63-67	11-15	25-33	11-15	76
	3VZ-FE	3.0 (2952)	⑥	①	②	181	61	13	29	13	76
	1FZ-FE	4.5 (4477)	⑦	⑧	⑩	304	-	15	29	15	108
1995	22R-E	2.4 (2366)	53-63	69-83	40-47	120-130	73-86	13-19	26-36	11-15	76
	2RZ-FE	2.4 (2438)	⑨	⑬	⑪	193	65	22	36	14	76
	3RZ-FE	2.7 (2693)	⑨	⑬	⑪	⑫	⑫	22	36	14	76
	5VZ-FE	3.4 (3378)	③	②	⑫	176-186	63-67	11-15	25-33	11-15	76
	1FZ-FE	4.5 (4477)	⑦	⑧	⑩	304	-	15	29	15	108
1996	2RZ-FE	2.4 (2438)	⑨	⑬	⑪	193	65	22	36	14	76
	3RZ-FE	2.7 (2693)	⑨	⑬	⑪	⑫	⑫	22	36	14	76
	5VZ-FE	3.4 (3378)	③	②	⑫	176-186	63-67	11-15	25-33	11-15	76
	1FZ-FE	4.5 (4477)	⑦	⑧	⑩	304	-	15	29	15	108

1 Step 1: 18 ft. lbs.
Step 2: 90 degree turn
2 Step 1: 45 ft. lbs.
Step 2: 90 degree turn
3 Step 1: 27 ft. lbs.
Step 2: 33 ft. lbs.
Step 3: 90 degree turn
Step 4: 90 degree turn
4 17mm bolts: 85 ft. lbs.
19mm bolts: 99 ft. lbs.
5 14mm bolts: 37 ft. lbs.
17mm bolts: 51 ft. lbs.
Nuts: 41 ft. lbs.
6 Step 1: 25 ft. lbs.
Step 2: 90 degree turn
Step 3: 90 degree turn
Recessed head bolt: 13 ft. lbs.
7 Step 1: 27 ft. lbs.
Step 2: 90 degree turn
Step 3: 90 degree turn
8 Step 1: 54 ft. lbs.
Step 2: 90 degree turn
9 Step 1: 29 ft. lbs.
Step 2: 90 degree turn
Step 3: 90 degree turn
10 Step 1: 35 ft. lbs.
Step 2: 90 degree turn
11 Step 1: 33 ft. lbs.
Step 2: 90 degree turn
12 Step 1: 19 ft. lbs.
Step 2: 90 degree turn
13 Step 1: 29 ft. lbs.
Step 2: 90 degree turn

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Engine

REMOVAL & INSTALLATION

CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning system.

In the process of removing the engine, you will come across a number of steps which call for the removal of a separate component or system, i.e. "disconnect the exhaust system" or "remove the radiator." In most instances, a detailed removal procedure can be found elsewhere in this manual.

It is virtually impossible to list each individual wire and hose which must be disconnected, simply because so many different model and engine combinations have been manufactured. Careful observation and common sense are the best possible additions to any repair procedure. Be absolutely sure to tag and wire or hose before it is disconnected, so that you can be assured of proper reconnection during installation.

22R Engine

1. Disconnect the negative battery cable.
2. Remove the engine undercover or splash shield.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in removal of tight and frozen nuts and bolts.

3. Disconnect the windshield washer hose. Scribe matchmarks around the hinges, then remove the hood.
4. Drain the engine oil. Drain the engine coolant from the radiator and the cylinder block.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

5. Drain the automatic transmission fluid on models so equipped.
6. Disconnect the air cleaner hoses and then remove the air cleaner.
7. Remove the fan coupling with the fan.
8. Disconnect the two heater hoses at the engine.
9. Remove the radiator with the shroud attached.
10. Disconnect the accelerator cable at the carburetor.
11. Tag and disconnect the following wires:
    - Vacuum switching valve (VSV) wire at the evaporative emissions (EVAP) canister
    - Vacuum switching (VSV) valve wire at the air conditioning compressor
    - Vacuum switch wire
    - HAC wire (ex. Calif.)
    - Cold mixture heater wire
    - Fuel cut solenoid wire
    - Water temperature sender gauge wire
    - Electronic air control (EACV) valve wire (Calif.)
    - Starter wire
    - Oil pressure switch wire
12. Disconnect the following parts:
    - Brake booster hose
    - Main fuel line at the fuel inlet pipe
    - Fuel return line at the fuel return pipe
    - Charcoal canister hose
    - HAC from the bracket (except Calif.)
    - Vacuum switch, Electronic Bleed Air Control Valve (EBCV) Calif. and Vacuum Switching Valve (VSV) with its bracket
13. Remove the drive belt.
14. Remove the power steering pump from its bracket (if equipped). Move the pump to one side without disconnecting the hoses. Use a piece of stiff wire to support it. Disconnect the ground strap from the bracket.
15. On models with air conditioning, loosen the drive belt and remove the air conditioning compressor. Position it out of the way with the refrigerant lines still attached. Use several pieces of stiff wire to support the compressor.
16. Disconnect the engine ground straps at the rear and right side of the engine.
17. On trucks with a manual transmission, remove the shift lever from inside the truck.
18. On models with automatic transmission, remove the shift lever retainer.
19. Remove the rear driveshaft.
20. On vehicles with automatic transmissions, disconnect the manual shift linkage at the neutral start switch. On 4WD models with automatic transmission, disconnect the transfer shift linkage at the cross-shaft.
21. Remove the cross-shaft from the body.
22. Disconnect the speedometer cable. Be sure not to lose the felt dust protector and washers.
23. On 4WD models, remove the transfer case undercover.
24. On 4WD models, remove the stabilizer bar.
25. On 4WD models, remove the front driveshaft.
26. Remove the No. 1 frame crossmember.
27. Disconnect the oxygen sensor wiring. Disconnect the exhaust pipe at the manifold; remove the clamp from the clutch housing. Remove the exhaust pipe from the catalytic converter.
28. On models with manual transmission, remove the clutch release (slave) cylinder and its bracket from the transmission.
29. Remove the No. 1 front floor heat insulator and the brake tube heat insulator (4WD only).
30. On 2WD models, remove the four rear engine mount bolts. Raise the transmission slightly with a floor jack and then remove the four support member mounting bolts.
31. On 4WD models, remove the four rear engine mount bolts, raise the transmission slightly with a floor jack and then

remove the four bolts from the side member and remove the No. 2 frame crossmember.

32. Attach an engine hoist chain to the lifting brackets on the engine. Remove the engine mount nuts and bolts and slowly lift the engine/transmission out of the truck.

33. Remove the starter. If automatic transmission, remove the oil cooler lines from the transmission. Remove the two stiffener brackets and the exhaust pipe bracket from the engine.

34. Remove the transmission.

35. If manual transmission, remove the clutch cover (pressure plate) and clutch disc.

36. Mount the engine on an engine stand, making sure the retaining bolts are tight. If an engine stand is not available, support the engine in an upright position with blocks. Never leave an engine hanging from a lift or hoist.

To install:

37. Install the clutch and pressure plate onto the engine. Tighten the bolts correctly.

38. Install the transmission onto the engine.

39. Slowly lower the engine assembly into the engine compartment.

40. On 4WD models, use a floor jack to raise the transmission onto the crossmember. Always use a piece of wood between the jack and the transmission pan.

41. Align the holes in the engine mounts and the frame, install the bolts and then remove the engine hoist chain.

42. On 2WD models, raise the transmission slightly and align the rear engine mount with the support member. Tighten the bolts to 9 ft. lbs. (13 Nm). Lower the transmission until it rests on the extension housing and then tighten the bracket mounting bolts to 19 ft. lbs. (25 Nm).

43. On 4WD models, raise the transmission slightly and tighten the No. 2 frame crossmember-to-side frame bolts to 70 ft. lbs. (95 Nm). Lower the transmission and tighten the four rear engine mount bolts to 9 ft. lbs. (13 Nm).

44. On 4WD models, install the brake tube and front floor heat insulators.

45. Install the clutch release (slave) cylinder and its bracket to the manual transmission. Tighten the bracket bolts to 29 ft. lbs. (39 Nm) and the cylinder bolts to 9 ft. lbs. (13 Nm).

46. Reconnect the exhaust pipe to the catalytic converter and to the exhaust manifold. Install the clamps. Install the wiring to the oxygen sensor.

47. Install the No. 1 frame crossmember.

48. On 4WD models, install the front driveshaft, stabilizer bar and the transfer case undercover.

49. Connect the speedometer cable.

50. On 4WD models with automatic transmission, install the cross-shaft to the body. Connect the transfer shift linkage.

51. Connect the manual shift linkage to the neutral start switch (automatic transmission only).

52. Install the rear driveshaft.

53. Install the shift lever (manual transmission) or the shift lever retainer (automatic)

54. Connect the engine ground straps.

55. Install the air conditioning compressor.

56. Install the power steering pump and connect the ground strap to the bracket.

57. Connect all parts removed earlier:

- Brake booster hose
- Main fuel line at the fuel inlet pipe
- Fuel return line at the fuel return pipe
- Charcoal canister hose
- HAC from the bracket (ex. Calif.)
- Vacuum switch, Electronic Bleed Air Control Valve (EBCV) Calif. and Vacuum Switching Valve (VSV) with its bracket

58. Connect all wires removed earlier:

- Vacuum Switching Valve (VSV) wire at the evaporative emissions (EVAP) canister
- Vacuum Switching Valve (VSV) wire at the air conditioning compressor
- Vacuum switch wire
- HAC wire (ex. Calif.)
- Cold mixture heater wire
- Fuel cut solenoid wire
- Water temperature sender gauge wire
- EACV wire (Calif.)
- Starter wire
- Oil pressure switch wire

59. Connect the accelerator cable to the carburetor, don't forget the tension spring.

60. Install the fan pulley, belt guide, fluid coupling and alternator drive belt.

61. Install the air conditioning compressor belt and adjust it correctly.

62. Install the power steering pump and belt; adjust the belt correctly. Tighten the pump pulley locknut to 32 ft. lbs. (43 Nm).

63. Install the radiator and shroud. Install the radiator hoses.

64. Connect the two heater hoses and install the air cleaner. Connect the air cleaner hoses.

65. Refill the engine with oil and the radiator with coolant.

66. Install the engine undercover.

67. Install the battery.

68. Install the hood.

69. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.

70. With the coil wire disconnected from the distributor, crank the engine with the ignition key for 5-10 seconds. This should pre-oil at least the lower part of the engine.

71. Reconnect the coil wire. Start the engine, allowing it to warm up. Check carefully for leaks.

72. Check and adjust the engine specifications as necessary.

73. Road test the vehicle. Recheck and top fluid levels as needed.

22R-E Engine

➧ See Figures 7, 8, 9 and 10

1. Disconnect the windshield washer hose. Scribe matchmarks around the hinges then remove the hood.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

2. Relieve the fuel pressure.

3. Disable the air bag system.

✻✻CAUTION

Fuel injected engine systems remain under pressure after the engine has been turned OFF. Properly relieve the fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

4. Disconnect the negative battery cable.
5. Remove the engine undercover.
6. Drain the engine oil. Drain the engine coolant from the radiator and the cylinder block.

✻✻CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

7. Drain the automatic transmission fluid on models so equipped.
8. Remove the air cleaner case and the intake air hose.
9. Remove the radiator and shroud.

✻✻CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

10. Loosen the power steering pulley locknut and remove the power steering belt.
11. If equipped with air conditioning, remove the compressor belt.
12. Remove the alternator drive belt, fluid coupling for the fan and the fan pulley.
13. Disconnect the following wires and connectors:
    - Ground strap from the left fender apron
    - Alternator connector and wire
    - Igniter
    - Alternator wires
    - Coil wire from distributor
    - Ground strap at rear of engine
    - Electronic Control Unit (ECU)
    - Starter relay connector (manual transmission only)
    - The check connector
    - Air conditioning compressor connector
14. Disconnect and label these hoses: air hoses from the fuel filter and air pipe, brake booster hose, charcoal canister hose and cruise control vacuum hose if so equipped.
15. Disconnect the accelerator cable, throttle cable for the automatic transmission (if so equipped) and the cruise control cable if so equipped.
16. Remove the power steering pump from its bracket (if equipped).
17. Disconnect the ground strap from the bracket.
18. On models with air conditioning, remove the air conditioning compressor. Position it out of the way with the refrigerant lines still attached.
19. Disconnect the engine ground straps at the rear and right side of the engine.
20. On trucks with a manual transmission, remove the shift lever from inside the truck.
21. Remove the rear driveshaft.
22. On models with automatic transmission, disconnect the manual shift linkage at the neutral start switch.
23. On 4WD models with automatic transmission, disconnect the transfer shift linkage at the cross-shaft.
24. Remove the cross-shaft assembly from the body.
25. Disconnect the speedometer cable. Be sure not to lose the felt dust protector and washers.
26. Remove the transfer case undercover (4WD only).
27. Remove the stabilizer bar (4WD only).
28. Remove the front driveshaft (4WD only).
29. Remove the No. 1 frame crossmember.
30. Disconnect the oxygen sensor wiring. Disconnect the exhaust pipe at the manifold; remove the clamp from the clutch housing. Remove the exhaust pipe from the catalytic converter.
31. On models with manual transmission, remove the clutch release (slave) cylinder and its bracket from the transmission.
32. Remove the No. 1 front floor heat insulator and the brake tube heat insulator (4WD only).
33. On 2WD models, remove the four rear engine mount bolts. Raise the transmission slightly with a floor jack and then remove the support member mounting bolts.
34. On 4WD models, remove the four rear engine mount bolts, raise the transmission slightly with a floor jack and then remove the four bolts from the side member and remove the No. 2 frame crossmember.
35. Attach an engine hoist chain to the lifting brackets on the engine. Remove the engine mount nuts and bolts and slowly lift the engine/transmission out of the truck.
36. Remove the starter. If automatic transmission, remove the oil cooler lines from the transmission. Remove the two

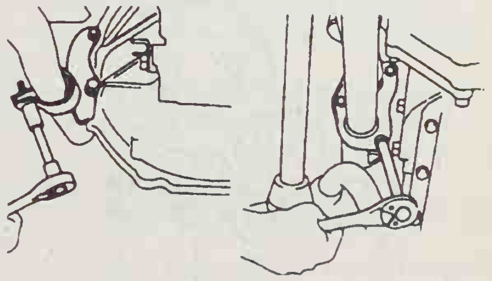

Fig. 7 Remove the bolts securing the front exhaust pipe to the engine and manifold

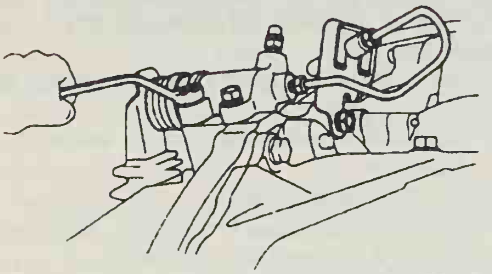

Fig. 8 On manual transmissions, remove the bolts securing the slave cylinder

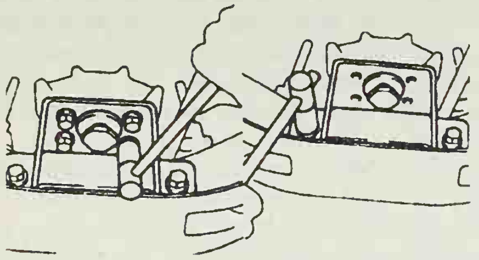

Fig. 9 On 2WD models, remove the four rear engine mount bolts first, then the remaining support member bolts

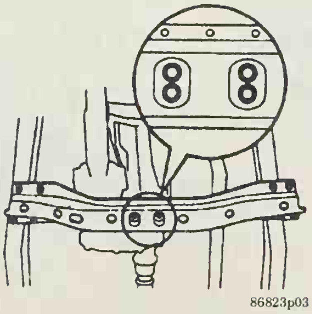

Fig. 10 On 4WD models, remove these frame crossmember bolts

stiffener brackets and the exhaust pipe bracket from the engine.

37. Remove the transmission.

38. If manual transmission, remove the clutch cover (pressure plate) and clutch disc.

39. Mount the engine on an engine stand, making sure the retaining bolts are tight. If an engine stand is not available, support the engine in an upright position with blocks. Never leave an engine hanging from a lift or hoist.

To install:

40. Slowly lower the engine assembly into the engine compartment.

41. Raise the transmission onto the crossmember with a floor jack.

42. Align the holes in the engine mounts and the frame, install the bolts and then remove the engine hoist chain.

43. On 2WD models, raise the transmission slightly and align the rear engine mount with the support member and tighten the bolts to 9 ft. lbs. (13 Nm). Lower the transmission until it rests on the extension housing and then tighten the bracket mounting bolts to 19 ft. lbs. (25 Nm).

44. On 4WD models, Raise the transmission slightly and tighten the No. 2 frame crossmember-to-side frame bolts to 70 ft. lbs. (95 Nm). Lower the transmission and tighten the four rear engine mount bolts to 9 ft. lbs. (13 Nm).

45. On 4WD models, install the brake tube and front floor heat insulators.

46. Install the clutch release (slave) cylinder and its bracket to the manual transmission. Tighten the bracket bolts to 29 ft. lbs. (39 Nm) and the cylinder bolts to 9 ft. lbs. (13 Nm).

47. Reconnect the exhaust pipe.

48. Install the No. 1 frame crossmember.

49. On 4WD models, install the front driveshaft, stabilizer bar and the transfer case undercover.

50. Connect the speedometer cable.

51. Connect the transfer shift linkage on 4WD models with automatic transmission.

52. Connect the manual shift linkage to the neutral start switch (automatic transmission only).

53. Install the rear driveshaft.

54. Install the shift lever (manual transmission only).

55. Connect the engine ground straps.

56. Install the air conditioning compressor.

57. Install the power steering pump and connect the ground strap.

58. Connect the accelerator cable, throttle cable for the automatic transmission (if so equipped) and the cruise control cable if removed.

59. Connect the hoses to the charcoal canister, the brake booster, the cruise control if so equipped and the air hoses to the fuel filter and air pipe.

60. Attach the wires and connectors:
   - Ground strap from the left fender apron
   - Alternator connector and wire
   - Igniter
   - Alternator wires
   - Coil wire from distributor
   - Ground strap at rear of engine
   - Electronic control unit (ECU) connectors
   - Starter relay connector (manual transmission only)
   - The check connector
   - Air conditioning compressor connector

61. Install the fan pulley, belt guide, fluid coupling and alternator belt.

62. Install the air conditioning compressor drive belt.

63. Install the power steering pump belt and adjust it correctly. Tighten the pump pulley locknut to 32 ft. lbs. (43 Nm).

64. Install the radiator and shroud.

65. Install the air cleaner case and the intake duct.

66. Install the proper amounts of oil and coolant.

67. Install the undercover or splash shield below the engine.

68. Install the battery.

69. Install the hood.

70. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.

71. With the coil wire disconnected from the distributor, crank the engine with the ignition key for 5-10 seconds. This should pre-oil at least the lower part of the engine.

72. Reconnect the coil wire. Start the engine, allowing it to warm up. Check carefully for leaks.

73. Check and adjust the engine specifications as necessary.

74. Road test the vehicle. Recheck and top fluid levels as needed.

3VZ-E Engine

See Figures 11, 12, 13, 14, 15, 16 and 17

1. Relieve the fuel pressure.

CAUTION

Fuel injected engine systems remain under pressure after the engine has been turned OFF. Properly receive the fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

2. Disconnect the windshield washer hose. Scribe matchmarks around the hinges, then remove the hood.

3. Disconnect the battery cables and remove the battery.

Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

4. Remove the engine undercover.

5. Drain the engine oil. Drain the engine coolant from the radiator and the cylinder block.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

6. Drain the automatic transmission fluid on models so equipped.

7. Disconnect the air cleaner hose and then remove the air cleaner.

8. Remove the cooling fan.

9. Remove the radiator.

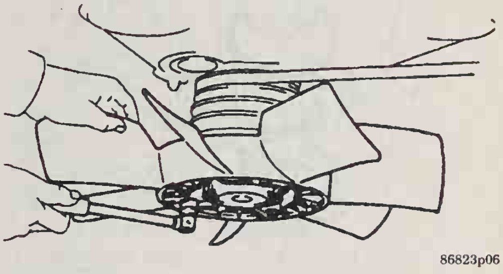

Fig. 11 Hold the fan while loosening the retaining bolts

10. Remove all drive belts and then remove the fluid coupling and fan pulley.

11. Tag and disconnect the following wires and connectors:
    - Left side and rear ground straps
    - Alternator connector and wire
    - Igniter
    - Oil pressure switch
    - Electronic Control Unit (ECU)
    - Vacuum Switching Valve (VSV)
    - Starter relay (manual transmission only)
    - Solenoid resistor
    - Check connector
    - Air conditioning compressor

12. Tag and disconnect the following hoses:
    - Air hoses at the gas filter and air pipe
    - Brake booster
    - Cruise control vacuum hose (if equipped)
    - Charcoal canister hose at the canister
    - Vacuum Switching Valve (VSV)
    - Oil cooler — (automatic transmissions)

13. Disconnect the accelerator cable, throttle control cable (auto. trans.) and cruise control cable if equipped.

14. Unbolt the power steering pump and position it out of the way with the hydraulic lines still connected.

15. Remove the air conditioning compressor if equipped. Position is out of the way with the lines still attached.

16. On manual transmissions, disconnect the clutch release (slave) cylinder hose.

17. Disconnect the two heater hoses from the engine.

18. Disconnect and plug the fuel inlet and outlet lines.

19. Remove the shift levers (manual transmission only).

20. Remove the rear driveshaft.

21. Disconnect the manual shift linkage (automatic transmission only).

22. Disconnect the speedometer cable — don't lose the felt dust protector and washers.

23. Remove the transfer case undercover.

24. Remove the stabilizer bar.

25. Remove the front driveshaft.

26. Remove the No.1 frame crossmember.

27. Remove the front exhaust pipe.

28. Remove the front floor heat insulator and the brake tube heat insulator.

29. Remove the four rear engine mount bolts. Raise the transmission slightly with a floor jack and remove the bolts securing the bracket and frame crossmember.

30. Attach an engine hoist chain to the lifting brackets on the engine. Remove the engine mount nuts and bolts and slowly lift the engine/transmission out of the truck.

31. Remove the starter. If automatic transmission, remove the oil cooler lines from the transmission. Remove the two stiffener brackets and the exhaust pipe bracket from the engine.

32. Remove the transmission.

33. If manual transmission, remove the clutch cover (pressure plate) and clutch disc.

34. Mount the engine on an engine stand, making sure the retaining bolts are tight. If an engine stand is not available, support the engine in an upright position with blocks. Never leave an engine hanging from a lift or hoist.

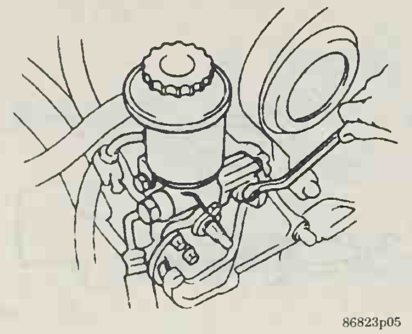

Fig. 12 Remove the bolts securing the power steering pump, then position it aside

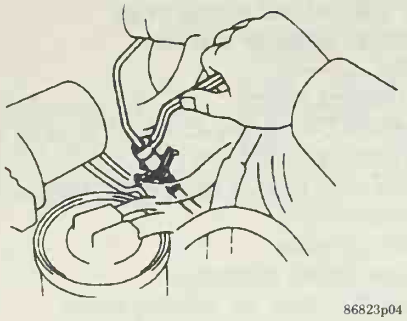

Fig. 13 On the manual transmissions, disconnect the slave cylinder hose from the pipe

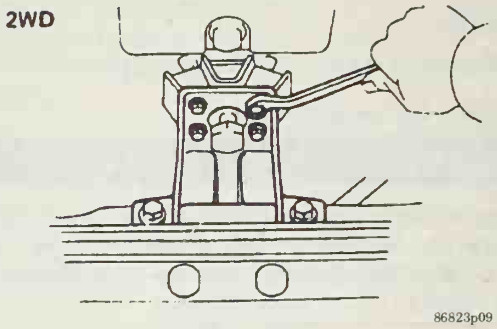

Fig. 15 On 2WD vehicles, first remove the 4 rear engine mount bolts . . .

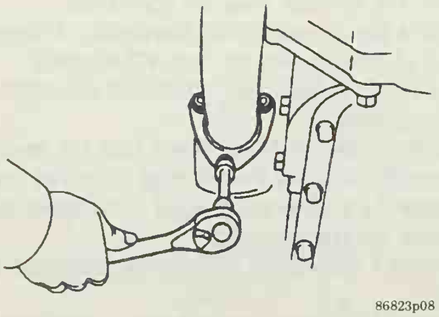

Fig. 14 Remove the bolts securing the front exhaust pipe to the manifold

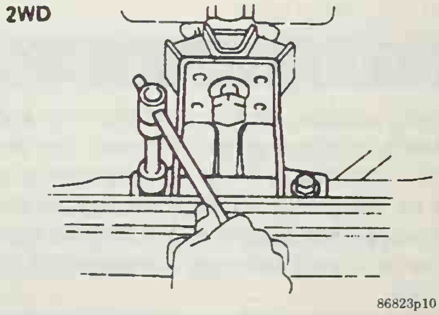

Fig. 16 . . . then remove the remaining bracket bolts

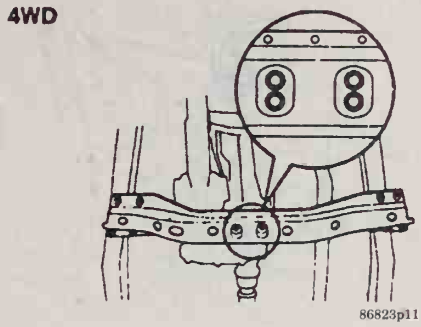

Fig. 17 On 4WD models, remove these crossmember bolts

To install:

35. After connecting the transmission to the engine and installing the starter, slowly lower the engine assembly into the engine compartment.
36. Raise the transmission onto the crossmember with a floor jack. Be certain to use a broad piece of wood between the transmission pan and the floor jack.
37. Align the holes in the engine mounts and the frame, install the bolts and then remove the engine hoist chain.
38. For 2WD vehicles, install the rear engine mount and bracket. Install the bolts holding the bracket to the support and tighten them to 9 ft. lbs. (13 Nm). Lower the transmission, resting it on the extension housing. Install the bracket to the mount; tighten the bolts to 19 ft. lbs. (25 Nm)
39. On 4WD vehicles, raise the transmission slightly and tighten the No. 2 frame crossmember-to-side frame bolts to 70 ft. lbs. (95 Nm). Lower the transmission and tighten the four rear engine mount bolts to 9 ft. lbs. (13 Nm).
40. Install the brake tube and front floor heat insulators.
41. Reconnect the exhaust pipe.
42. Install the No. 1 frame crossmember.
43. Install the front driveshaft.
44. Install the stabilizer bar and the transfer case undercover. Connect the speedometer cable.
45. Connect the manual shift linkage (automatic transmission only).
46. Install the rear driveshaft.
47. Install the shift levers (manual transmission only).
48. Install the fuel inlet and outlet lines.
49. Connect the heater hoses.
50. Connect the clutch release (slave) cylinder hose.
51. Install the air conditioning compressor.
52. Install the power steering pump and connect the ground strap.
53. Connect the throttle, cruise control and accelerator cables.
54. Connect the hoses:
    - Air hoses at the fuel filter and air pipe
    - Brake booster
    - Cruise control vacuum hose (if equipped)
    - Charcoal canister hose at the canister
    - Vacuum Switching Valve (VSV)
55. Connect the wires:
    - Left side and rear ground straps
    - Alternator connector and wire
    - Igniter
    - Oil pressure switch
    - Electronic Control Unit (ECU)
    - Vacuum Switching Valve (VSV)
    - Starter relay (manual transmission only)
    - Solenoid resistor
    - Check connector
    - Air conditioning compressor
56. Install the fan pulley, belt guide, fluid coupling and drive belt.
57. Inspect and replace the air conditioning belt.
58. Install the power steering pump and connect the ground strap. Tighten the pump pulley locknut to 32 ft. lbs. (43 Nm).
59. Install the radiator and attach the shroud.
60. Install the air cleaner. Refill the engine with oil and the radiator with coolant.
61. Install the engine undercover.
62. Install and adjust the hood.
63. Install the battery.
64. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.
65. With the coil wire disconnected from the distributor, crank the engine with the ignition key for 5-10 seconds. This should pre-oil at least the lower part of the engine.
66. Reconnect the coil wire. Start the engine, allowing it to warm up. Check carefully for leaks.
67. Check and adjust the engine specifications as necessary.
68. Road test the vehicle. Recheck and top fluid levels as needed.

5VZ-FE Engine

2WD MODELS

➧ See Figures 18, 19, 20, 21 and 22

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

1. Remove the hood.
2. Relieve the fuel pressure.
3. Disable the air bag system. Refer to Section 6.

⁂CAUTION

Work must be started only after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative battery cable is disconnected.

4. Disconnect the battery and remove it from the vehicle.
5. Raise and safely support the vehicle.
6. Remove the engine under covers.

7. Drain the engine coolant.
8. Drain the engine oil.

⁂CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

9. Remove the radiator.
10. Remove the power steering drive belt:
    a. Stretch the belt and loosen the fan pulley mounting bolts.
    b. Loosen the lock, pivot and adjusting bolts. Remove the drive belt from the engine.
11. If equipped with A/C, remove the A/C drive belt by loosening the idle pulley nut and adjusting bolt.
12. Loosen the lock, pivot and adjusting bolts, then remove the alternator belt.
13. Remove the fan with the fluid coupling and the fan pulleys.
14. Disconnect the power steering pump from the engine and set aside. Do not disconnect the lines from the pump.
15. If equipped with A/C, disconnect the compressor from the engine and set aside. Do not disconnect the lines from the compressor.
16. Remove the air cleaner lid, Mass Air Flow (MAF) meter and resonator.
17. Remove the air cleaner case and filter assembly.
18. Disconnect the following cables:
    - If the vehicle has cruise control, disconnect the detent cable
    - Accelerator
    - Throttle cable on automatics
19. Disconnect the heater hoses.
20. Disconnect the following hoses:
    - Brake booster vacuum
    - Evaporative emissions (EVAP)
    - Fuel return
    - Fuel inlet
21. Disconnect the starter wire and connectors as follows:
    a. Remove the bolt retaining the ground strap.
    b. Disconnect the positive battery cable.
    c. Disconnect the starter wires and connectors.
22. Disconnect the alternator harness.
23. Remove the engine harness as follows:
    a. Remove the four screws to the right front door scuff plate.
    b. Remove clip retaining the cowl panel side trim.
    c. Disconnect the Electronic Control Unit (ECU) wiring.
    d. Detach the two connectors from the cowl wire.
    e. Disconnect the igniter.
    f. Detach the ground strap.
    g. Disconnect the six engine wire clamps.
    h. Pull the engine wire from the compartment.

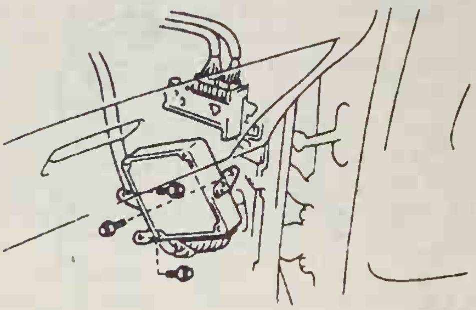

Fig. 18 The Electronic Control Unit (ECU) can be found behind the passenger's side kick panel

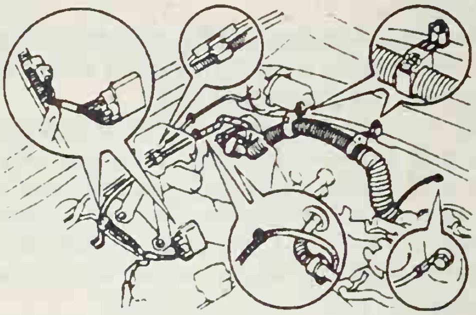

Fig. 19 Remove the clamps securing the engine wiring harness at the points shown

24. If equipped with a manual transmission, remove the shift lever as follows:
    a. Remove the shift lever knob.
    b. Remove the four screws and the shift lever boot.
    c. Remove the six bolts to retrieve the shift lever assembly and gasket.
25. Remove the stabilizer bar.
26. Remove the driveshaft from the transmission.
27. Disconnect the speedometer cable.
28. Remove the front exhaust pipe as follows:
    a. Disconnect the heated oxygen sensor.
    b. Remove the two bolts and retainer holding the front pipe to the catalytic converter.
    c. Remove the three bolts and the support bracket.
    d. Loosen and remove the three nuts holding the front pipe and gaskets.
29. If equipped with with a manual transmission, remove the slave cylinder.
30. On automatic transmissions, remove the cross-shaft.
31. Place a jack under the transmission.

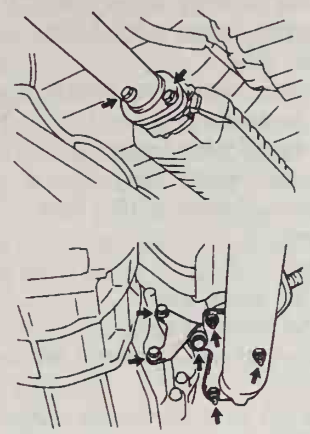

Fig. 20 Remove the bolts securing the front exhaust pipe to the manifold, support bracket and catalytic converter

32. Remove the eight bolts retaining the transmission rear mounting bracket.
33. If equipped with A/C, remove the bolt and disconnect the wire.
34. Attach the engine hoist chain to the two engine hangers.
35. Remove the four bolts and nuts holding the front mounting insulators to the frame.
36. Lift the engine and transmission out of the vehicle.

To install:

37. Install the engine assembly to the vehicle. Attach the engine mounts to the body mountings, then install bolts and nuts. Do not tighten them.
38. Remove the engine hoist from the engine hangers.
39. If equipped with A/C, connect the A/C wire with the bolt.
40. Raise and support the transmission slightly to install the mounting bracket. Tighten the bolts to the frame to 43 ft. lbs. (58 Nm) along with the bolts to the mounting bracket insulator to 13 ft. lbs. (18 Nm).
41. Tighten the engine mounting nuts and bolts to 28 ft. lbs. (38 Nm).

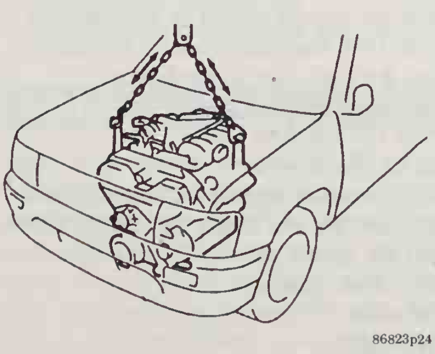

Fig. 21 Attach the engine hoist chain to the engine hangers

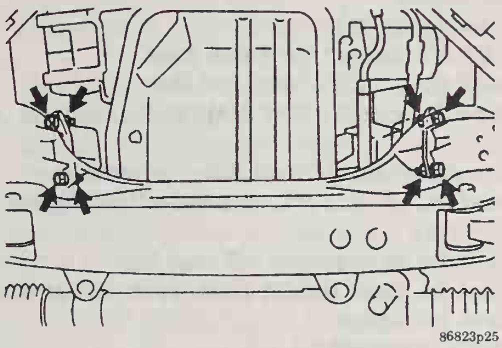

Fig. 22 Remove these four bolts and nuts that secure the engine mounting insulators to the frame

42. If equipped with an automatic transmission, install the cross-shaft.
43. On manual transmissions, install the slave cylinder, tighten the mounting bolts to 9 ft. lbs. (12 Nm).
44. Attach the front exhaust pipe:
    a. Install the gaskets and attach the pipe to the engine with new mounting nuts. Tighten the nuts to 36 ft. lbs. (44 Nm).
    b. Install the support bracket and tighten the bolts to 33 ft. lbs. (44 Nm).
    c. Connect the exhaust pipe with a new gasket to the catalytic converter. Tighten the bolts to 35 ft.. lbs. (48 Nm).
    d. Connect the two heated oxygen sensors.
45. Attach the speedometer cable.
46. Install the driveshaft.
47. Attach the stabilizer bar.
48. Install the shift lever assembly:
    a. Using a new gasket, secure the shift lever assembly with its retainers.
    b. Install the shift lever boot.
    c. Install the shifter lever knob.
49. Connect the engine harness and wiring:
    a. Push the engine wiring into the cabin.
    b. Connect the engine wire clamps.
    c. Attach the ground strap.
    d. Install and connect the igniter.
    e. Attach the two connectors to the cowl wire.
    f. Connect the Electronic Control Unit (ECU).
    g. Install the scuff plate to the vehicle.
    h. Install the cowl panel side trim.
50. Connect the alternator wires.
51. Attach the starter wires:
    a. Install the starter clamps and connectors.
    b. Install the nuts and attach the positive battery cable.
    c. Install the ground strap.
52. Connect the hoses:
    - Fuel inlet
    - Fuel return
    - Evaporative emissions (EVAP)
    - Brake booster vacuum
53. Connect the heater hoses.

54. Connect the following cables:
    - If equipped with cruise control, attach the actuator cable with bracket
    - Accelerator cable
    - On A/T, connect the throttle cable
55. Install the air cleaner case and filter.
56. Install the Mass Air Flow (MAF) meter, resonator and air cleaner cover.
57. On vehicles with A/C, install the compressor.
58. Install the fan, fluid couplings and pulleys. Tighten to 48 inch lbs. (5 Nm).
59. Install the alternator and A/C drive belts.
60. Install the power steering pump, pulley and drive belt.
61. Install the radiator.
62. Fill the engine with oil.
63. Fill the cooling system.
64. Attach the engine splash shield.
65. Start the engine and check for leaks.
66. Top off any fluid levels.

4WD MODELS

➧ See Figures 18, 21 and 22

1. Disable the air bag system.
2. Remove the transmission from the vehicle.
3. Remove the hood.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

4. Disconnect the battery and remove it from the vehicle.

⁂CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative battery cable is disconnected.

5. Raise and support the vehicle safely.
6. Remove the engine splash shields.
7. Drain the engine coolant.
8. Drain the engine oil.
9. Remove the radiator.
10. Remove the Power Steering (PS) drive belt:
    a. Loosen the fan pulley mounting bolts.
    b. Loosen the lock, pivot and adjusting bolts. Remove the drive belt.
11. On A/C vehicles, loosen the idle pulley nut and adjusting bolt to remove the A/C drive belt.
12. Loosen the lock, pivot and adjusting bolts. Remove the drive belt.
13. Remove the fan, fluid coupling and pulleys.
14. Disconnect the PS pump from the engine and set aside. Do not disconnect the lines from the pump.
15. On A/C vehicles, disconnect the compressor from the engine and set aside. Do not disconnect the lines from the compressor.
16. Remove the air cleaner lid, Mass Air Flow (MAF) meter and resonator.
17. Remove the air cleaner assembly.
18. Disconnect the following cables:
    - Cruise control actuator and bracket
    - Accelerator cable
    - On automatics, remove the throttle cable
19. Disconnect the heater hoses.
20. Disconnect the following hoses:
    - Brake booster vacuum hose
    - Evaporative emissions (EVAP) hose
    - Fuel return
    - Fuel inlet
21. Disconnect the starter wire:
    a. Remove the ground strap.
    b. Remove the nuts and disconnect the positive battery cable.
    c. Disconnect the three starter wire clamps.
22. Disconnect the alternator harness.
23. Detach the engine harness:
    a. Remove the right front door scuff plate.
    b. Remove the cowl panel side trim.
    c. Disconnect the Electronic Control Unit (ECU).
    d. Disconnect the wires leading to the cowl.
    e. Remove the wiring to the igniter.
    f. Disconnect the ground strap.
    g. Remove the wire clamps.
    h. Pull out the engine wire from the cabin.
24. On A/C vehicles, remove the bolt and disconnect the compressor wire clamp.
25. Attach the engine hoist chain to the two engine hangers.
26. Remove the bolts and nuts holding the engine front mounting insulators to the frame.
27. Lift the engine out of the vehicle.

To install:

28. Install the engine assembly in the vehicle. Attach the engine mounts to the body mountings. Install the bolts and nuts but do not tighten them.
29. Remove the engine hoist chain from engine hangers.
30. If equipped with A/C, connect the A/C wire with the bolt.
31. Tighten the engine mounting nuts and bolts to 28 ft. lbs. (38 Nm).
32. Connect the engine harness and wiring:
    a. Push the engine wiring into the cabin.
    b. Connect the engine wire clamps.
    c. Attach the ground strap.
    d. Install and connect the igniter.
    e. Attach the two connectors to the cowl wire.
    f. Connect the Electronic Control Unit (ECU).
    g. Install the scuff plate to the vehicle.
    h. Install the cowl panel side trim.
33. Connect the alternator wires.
34. Attach the starter wires:
    a. Install the starter clamps and connectors.
    b. Install the nuts and attach the positive battery cable.
    c. Install the ground strap.
35. Connect these hoses:
    - Fuel inlet
    - Fuel return
    - Evaporative emissions (EVAP)
    - Brake booster vacuum
36. Connect the heater hoses.

37. Connect the following cables:
    - If equipped with cruise control, attach the actuator cable with bracket
    - Accelerator cable
    - On A/T, connect the throttle cable
38. Install the air cleaner case and filter.
39. Install the Mass Air Flow (MAF) meter, resonator and air cleaner cover.
40. Install the A/C compressor if equipped.
41. Install the fan, coupling and pulleys. Tighten the nuts to 48 inch lbs. (5 Nm).
42. Install the A/C drive belt.
43. Install the power steering pump, pulley and drive belt.
44. Install the radiator.
45. Fill the engine with oil.
46. Fill the cooling system.
47. Install the hood.
48. Attach the engine splash shield.
49. Install the transmission in the vehicle.
50. Start the engine and check for leaks.
51. Top off any fluid levels.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 23, 24, 25, 26, 27, 28 and 29

1. Turn the ignition **OFF**. Disable the air bag system, if equipped.
2. If not already done, disconnect the battery cables, negative first.

✻✻CAUTION

The air bag system is equipped with a back-up power source. To avoid possible air bag deployment, do not start working on the vehicle until 90 seconds has elapsed from the time the ignition switch is turned OFF and the negative battery terminal is disconnected.

3. Matchmark the hood hinges, then remove the hood.
4. Relieve the fuel system pressure.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

5. Remove the engine splash shield.
6. Drain the engine oil, transmission fluid and cooling system.

✻✻CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

7. To remove the radiator:
    a. Remove the parking lights from the grille.
    b. Remove the two fillers.
    c. Remove the grille from the vehicle.
    d. On some California models you may need to remove the bolts retaining the air pipe.
    e. Disconnect the upper radiator hose and the reservoir hose.
    f. Remove the No. 2 fan shroud if equipped.
    g. On automatics, disconnect the oil cooler hoses.
    h. Remove the lower radiator hose.
    i. Remove the four bolts retaining the radiator, and pull the radiator from the vehicle.
8. If equipped with power steering, loosen the lock bolt and adjusting bolt to the idler pulley, then remove the drive belt.
9. On A/C vehicles, loosen the idler pulley nut and adjusting bolt. Remove the drive belt.
10. Remove the alternator drive belt, fan, fan clutch, water pump pulley, and fan shroud as follows:
    a. Loosen the water pump pulley mounting bolts.
    b. Loosen the lock, pivot and adjusting bolts for the alternator and remove the alternator drive belt.
    c. Remove the water pump pulley mount nuts.
    d. Remove the fan (with clutch) and the water pump pulley.
11. On manual transmissions, disconnect the accelerator cable from the throttle body.
12. On automatics, disconnect the accelerator and throttle cables from the throttle body.
13. For vehicles with cruise control, remove the actuator cover and disconnect the cable.
14. Remove the air cleaner top, Mass Air Flow (MAF) meter and resonator. Remove the air cleaner assembly.
15. Remove the intake air connector.
16. On vehicles with A/C, disconnect the compressor and bracket:
    a. Disconnect the A/C compressor wiring.
    b. Remove the mounting bolts and mounting bracket. Do not disconnect the A/C pressure lines from the compressor. Suspend the compressor away from the engine.
    c. Remove the compressor bracket.
17. Detach the alternator wiring.
18. Remove the heater hoses at the cowl.

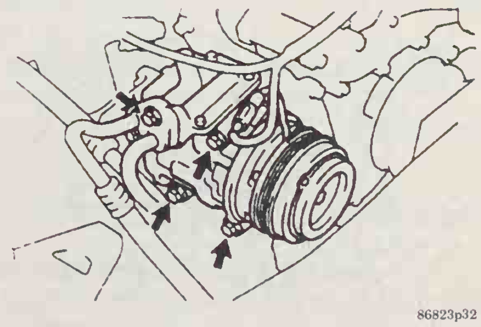

Fig. 23 Remove the bolts securing the A/C compressor, then position it aside

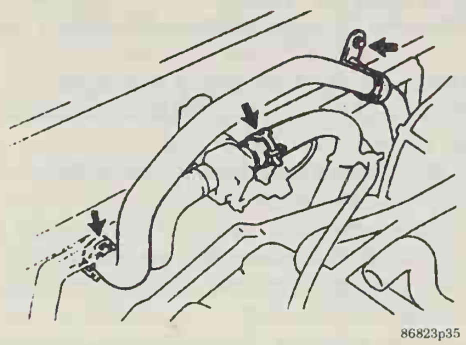

Fig. 24 Remove the clamps shown securing the heater hoses

19. Disconnect the following hoses:
    - Brake booster vacuum
    - Evaporative emissions (EVAP)
    - On vehicles with power steering, disconnect the two hoses
    - Fuel return
    - Fuel inlet
20. Remove the power steering pump:
    a. Using special service tool 09960-10010 or an equivalent spanner wrench, remove the nut and power steering pulley.
    b. Remove the two bolts and disconnect the power steering pump.
21. Disconnect the following engine wiring:
    a. Remove the igniter connection
    b. Disconnect the ground strap from the cowl top panel.
    c. Disconnect the two engine wire clamps.
    d. Remove the nuts holding the engine wire retainer to the cowl panel and pull out the engine wire from the vehicles cabin.

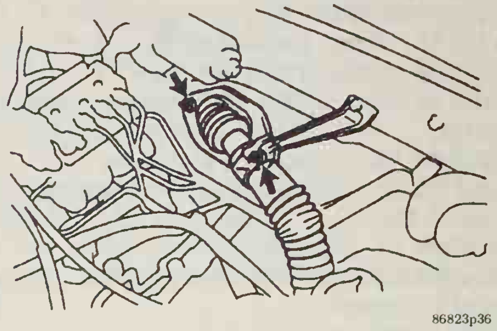

Fig. 26 Remove the bolts securing the engine wiring clamps

22. Disconnect the front exhaust pipe from the exhaust manifold and catalytic converter as follows:
    a. Disconnect the two heated oxygen sensors connectors.
    b. Remove the two bolts and retainer holding the front exhaust pipe to the catalytic converter.
    c. Loosen the clamp bolt and disconnect the clamp from the support bracket.
    d. Remove the two bolts to release the support bracket.
    e. Disconnect the three nuts, front exhaust pipe and gaskets from the exhaust manifold.
23. On manual transmissions, remove the shift lever assembly as follows:
    a. Remove the shift lever knob.
    b. Remove the shift lever boot.
    c. Loosen the retaining bolts for the shift lever assembly and baffle, then remove.
24. Remove the driveshaft from the vehicle.
25. Disconnect the speedometer cable from the transmission.
26. On manual transmissions, remove the slave cylinder.
27. On automatics, remove the cross-shaft.
28. Disconnect the wires at the starter.

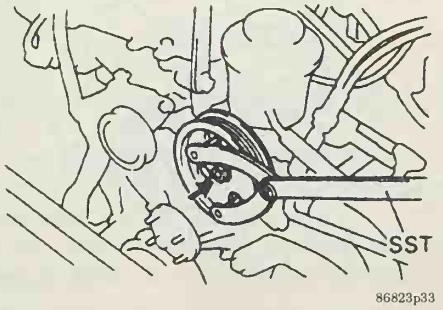

Fig. 25 A spanner wrench can be used to hold the pulley while removing the bolt

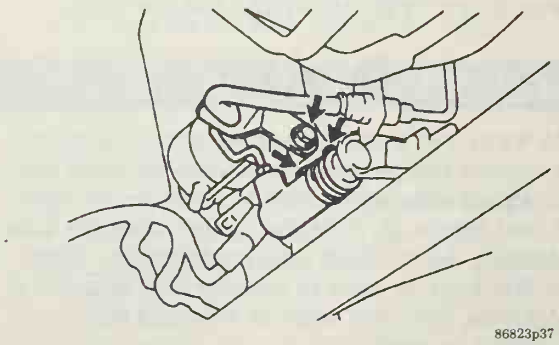

Fig. 27 On manual transmissions, the slave cylinder must be removed

29. Position a jack and wooden block under the transmission, then remove the rear engine mounting bracket.
30. Attach a suitable engine hoist to the engine hangers.
31. Remove the nuts and bolts from the engine mounts.

➡Make sure the engine/transmission assembly is clear of all the wiring and hoses.

32. Carefully lift the engine/transmission out of the vehicle.

To install:

33. Attach the engine hoist to the engine hangers. Carefully lower the engine/transmission into the vehicle. Keep the engine level, while aligning the engine mounts.
34. Install the engine mount fasteners, but do not fully tighten them.
35. Position a jack and wooden block under the transmission, then install the rear engine mounting bracket. Tighten the bolts to the frame to 19 ft. lbs. (58 Nm) and the bolts to the mount to 13 ft. lbs (18 Nm).
36. Remove the jack and engine hoist. Tighten the engine mounts to 28 ft. lbs. (38 Nm).

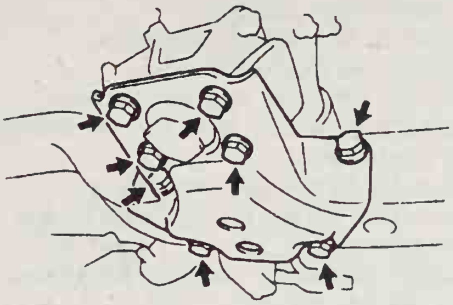

Fig. 28 Remove the bolts retaining the rear engine mounting bracket

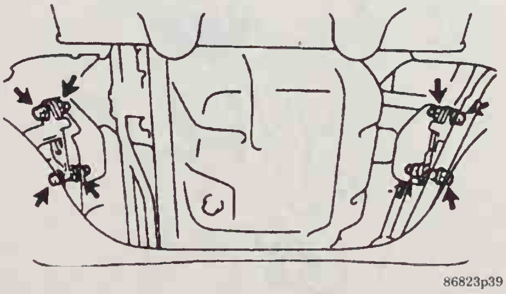

Fig. 29 The left and right engine mount retainers must be removed

37. Connect the starter wires.
38. On manual transmissions, install the slave cylinder.
39. On automatics, install the cross-shaft.
40. Connect the speedometer to the transmission.
41. Install the driveshaft.
42. On manual transmissions, install the shift lever assembly, shift lever boot and shift knob.
43. Install the front exhaust pipe to the manifold:
    a. Install the two gaskets and the front pipe to the manifold. Install the nuts and bolts, tighten the nuts to 46 ft. lbs. (62 Nm).
    b. Install the support bracket with the two bolts. Tighten the brackets to 29 ft. lbs. (39 Nm).
    c. Connect the clamp and tighten to 14 ft. lb.s (19 Nm).
    d. Install a new gasket on the front pipe and attach to the catalytic converter. Tighten the bolts to 29 ft. lbs. (39 Nm).
    e. Connect the heated oxygen sensor wiring.
44. Connect the engine wire:
    a. Push the engine wire through the cowl panel. Install the nuts to hold the engine wire retainer to the cowl.
    b. Attach the ground strap to the cowl panel.
    c. Attach the igniter harness to the unit.
    d. Install the two connectors to the cowl wire.
45. Attach the alternator wires.
46. Install the power steering pump to the bracket, tighten the bolts to 43 ft. lbs. (58 Nm).
47. With special service tool 09960-10010 or an equivalent spanner wrench, install the power steering pulley, tighten the nut to 32 ft. lbs. (43 Nm).
48. Connect the following hoses:
    - Brake booster vacuum
    - Evaporative emissions (EVAP)
    - On vehicles with power steering, connect the two hoses
    - Fuel return
    - Fuel inlet
49. Connect the engine heater hoses at the cowl panel.
50. On vehicles with A/C install the compressor:
    a. Attach the compressor bracket, tighten to 32 ft. lbs. (44 Nm).
    b. Attach the A/C compressor to the bracket, tighten the bolts 18 ft. lbs. (25 Nm).
51. Install the intake air connector, tighten the bolts to 13 ft. lbs. (18 Nm).
52. Install the water pump pulley, fan shroud, fan with fan clutch, and alternator drive belt:
    a. Place a fan (with the fan clutch), water pump pulley and and shroud in position.
    b. Install the water pump pulley mounting nuts but do not tighten them at this time.
    c. Install the alternator drive belt.
    d. Stretch the belt tight and tighten the fan nuts to 16 ft. lbs. (21 Nm).
    e. Adjust the drive belt for the alternator.
53. If equipped with A/C, install and adjust the drive belt.
54. Install the adjust the power steering drive belt.
55. On manual transmissions, connect the accelerator cable to the throttle body.
56. On automatics, connect the accelerator and throttle cables to the throttle body.
57. Install the air cleaner case.

58. Install the Mass Air Flow (MAF) meter, resonator and air cleaner cap.
59. Install the radiator to the vehicle with the tabs on the supports through the radiator service holes. Install the bolts and tighten them to 9 ft. lbs. (12 Nm).
60. Connect the lower radiator hose.
61. On automatic transmissions, connect the oil cooler hoses.
62. Connect the upper radiator hose.
63. If removed, connect the air pipe.
64. Install the radiator grille.
65. Attach the two fillers.
66. Attach the parking lights to the grille.
67. Fill the engine oil, coolant and transmission oil.
68. Connect the negative battery cable, then the positive cable.
69. Start the engine and check for leaks.
70. Check the ignition timing.
71. Install the engine splash shield.
72. Install the hood.
73. Road test the vehicle and recheck the fluids.

3F-E Engine

➧ See Figures 30, 31, 32, 33, 34, 35, 36, 37 and 38

1. Disconnect the negative battery cable.
2. Drain the engine coolant. Drain the engine oil.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Scribe matchmarks around the hood hinges, then remove the hood.
4. Relieve the fuel pressure.
5. Remove the battery and its tray.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

6. Disconnect the accelerator and throttle cables.
7. Disconnect the air flow meter connector and clamp. Disconnect the ISC hose, the air pump hose, distributor hose, PCV hose, the 3 hoses from the rear of the intake chamber, and the 2 vacuum hoses from the charcoal canister. Disconnect the air intake hose clamp.
8. Remove the air intake hose, air flow meter and air cleaner cap. Remove the air cleaner element. Remove the three bolts and the air cleaner case.
9. Remove the coolant reservoir tank; remove the radiator.
10. Tag and detached the following wires and connectors:
    - Oil pressure sensor
    - High tension cord at the coil
    - Neutral start switch and transfer near the starter
    - Front differential lock
    - Starter wire and connector
    - Starter ground strap
    - Oxygen sensor
    - Alternator wire and connector
    - Cooling fan
11. Disconnect the following hoses:
    - Heater
    - Fuel
    - Transfer Case
    - Brake booster
    - Distributor
12. Remove the glove box. Unplug the four connectors from the ECU. Carefully pull the wiring harness through the firewall.
13. Loosen the power steering pump pulley on its shaft. Loosen the idler pulley nut and bolt; remove the drive belt. Remove the pulley mounting nut, drive pulley and woodruff key. Unbolt the power steering pump and remove it from the bracket.
14. At the air conditioning compressor, disconnect the wiring lead. Loosen the idler pulley and adjuster, then remove the belt. Remove the 4 compressor mounting bolts. Position the compressor out of the way with the hoses still attached. Use stiff wire to support the unit; do not allow the compressor to hang by the hoses.
15. Raise the vehicle, making sure it is well supported. Remove the transfer case undercover.
16. Remove the front and rear driveshafts.
17. Disconnect the speedometer cable.
18. Disconnect the ground strap from the body.
19. Detach the two vacuum hoses from the diaphragm cylinder for the transfer case.
20. Remove the transfer case shift lever.
    a. Remove the clip and pin, disconnect the shift rod from the transfer case.
    b. Remove the nut, then disconnect the washers and the shift lever with the shift rod.
21. Disconnect the transmission control rod.
22. Disconnect the exhaust pipe at the manifold.
23. Position a floor jack under the transmission with a broad piece of wood to protect the pan. Remove the eight bolts and two nuts that attach the frame crossmember and then remove the crossmember.

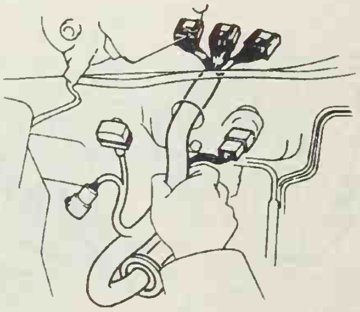

Fig. 30 Once disconnected, slide the harness through the cowl panel

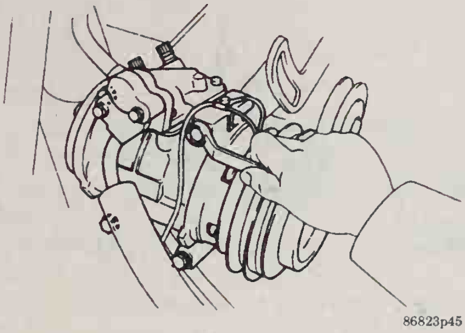

Fig. 31 Remove the compressor mounting bolts and position out of the way with the hoses attached.

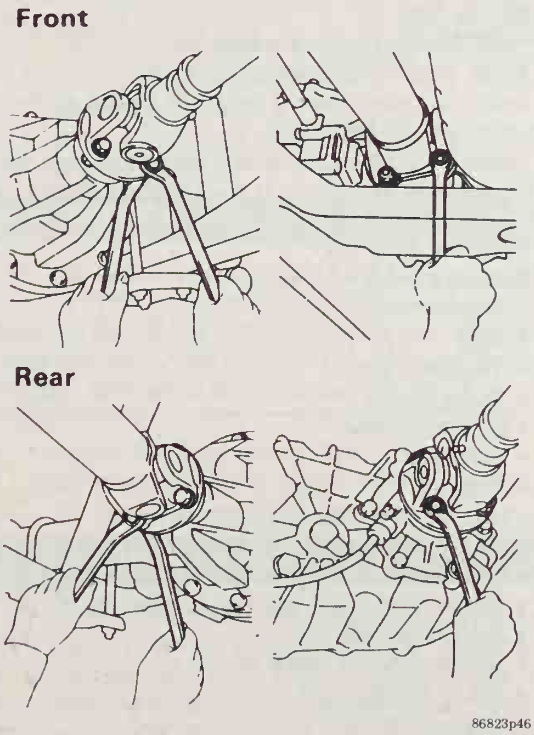
Front
Rear
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Fig. 32 Locations of the front and rear driveshafts bolts

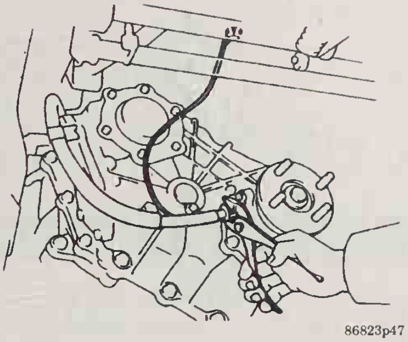

Fig. 33 Use a pair of pliers to loosen the speedometer cable fitting

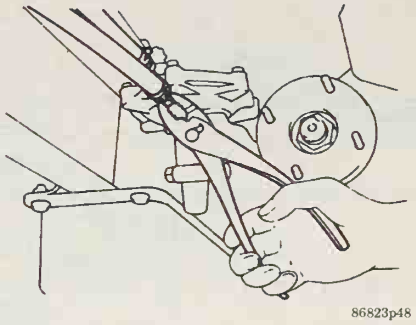

Fig. 34 Detach the two vacuum hoses from the diaphragm cylinder on the transfer case

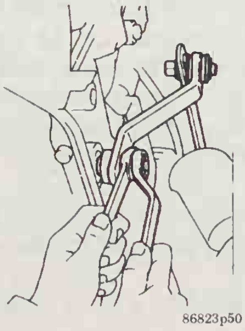

Fig. 35 Remove the two nuts securing the control rod on the transmission

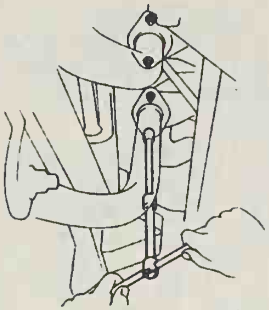

Fig. 36 Remove the nuts retaining the front exhaust pipe to the manifold

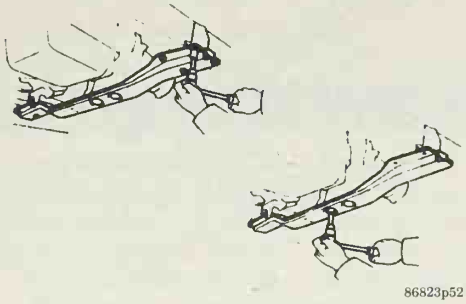

Fig. 37 Remove the outer crossmember bolts first, then the inner ones

24. Attach an engine hoist chain to the lifting brackets on the engine. Remove the engine mount nuts and bolts, then slowly lift the engine/transmission out of the truck.
25. Remove the oil cooler lines from the transmission.
26. Remove the transmission from the engine.
27. Mount the engine on an engine stand, making sure the retaining bolts are tight. If an engine stand is not available, support the engine in an upright position with blocks. Never leave an engine hanging from a lift or hoist.

To install:

28. Install the transmission and oil cooler lines to the engine. Slowly lower the engine assembly into the engine compartment.
29. Raise the transmission onto the crossmember with a floor jack.
30. Align the holes in the engine mounts and the frame, install the bolts and then remove the engine hoist chain.

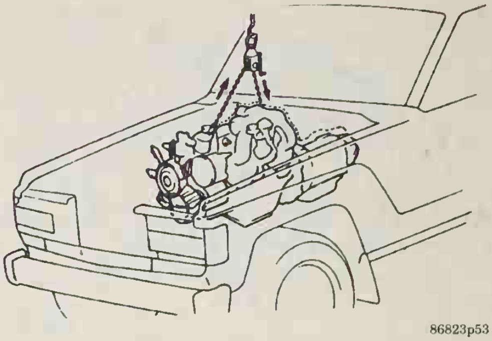

Fig. 38 Use an engine hoist to remove the engine and transmission as an assembly

31. Raise the transmission slightly and tighten the frame crossmember-to-chassis bolts to 29 ft. lbs. (39 Nm). Tighten the two nuts to 43 ft. lbs. (59 Nm).
32. Install the exhaust pipe with a new gasket and nuts. Tighten the nuts to 46 ft. lbs. (62 Nm).
33. Connect the speedometer cable.
34. Install the front and rear driveshafts. Tighten the nuts to 65 ft. lbs. (88 Nm).
35. Install the transfer case undercover.
36. Install the air conditioning compressor.
37. Install the power steering pump and tighten the pulley nut to 35 ft. lbs. (47 Nm).
38. Carefully feed the fuel injection harness through the firewall. Engage the 4 connectors to the Electronic Control Unit (ECU).
39. Install the glove box.
40. Connect the hoses removed:
    - Heater
    - Fuel
    - Transfer Case
    - Brake booster
    - Air control valve
    - Distributor
    - Emission
41. Attach the wires and connectors removed:
    - Oil pressure sensor
    - High tension cord at the coil
    - Neutral start switch and transfer near the starter
    - Front differential lock
    - Starter wire and connector
    - Starter ground strap
    - Oxygen sensor
    - Alternator wire and connector
    - Cooling fan
    - Check connector
    - Connector on right fender apron
42. Install the radiator and the coolant reservoir tank.

43. Install air cleaner case and the element. Install the air intake hose, air flow meter and air cleaner cap. Connect the hoses:

- ISC hose
- Air pump hose
- Distributor hose
- PCV hose
- 3 hoses from the rear of the intake chamber
- 2 vacuum hoses from the canister

44. Connect the accelerator and throttle cables. Be sure to adjust them.
45. Refill the engine with oil and the radiator with coolant.
46. Install the battery tray and battery.
47. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.
48. With the coil wire disconnected from the distributor, crank the engine with the ignition key for 5-10 seconds. This should pre-oil at least the lower part of the engine.
49. Reconnect the coil wire. Start the engine, allowing it to warm up. Check carefully for leaks.
50. Check and adjust the engine specifications as necessary.
51. Install the hood.
52. Road test the vehicle. Recheck and top fluid levels as needed.

1FZ-FE Engine

➧ See Figures 39, 40, 41, 42, 43, 44, 45, 46, 47, 48 and 49

1. Disable the air bag system.
2. Release the fuel pressure.
3. Disconnect the battery cables, negative first. Remove the battery and tray assembly.

⁂CAUTION

The air bag system is equipped with a back-up power source. To avoid possible air bag deployment, do not start working on the vehicle until 90 seconds has elapsed from the time the ignition switch is turned OFF and the negative battery terminal is disconnected.

4. Raise and safely support the vehicle.
5. Drain the engine coolant, transmission fluid and engine oil.

⁂CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

6. Scribe the hood hinges and remove the hood.
7. Remove the radiator grille and radiator.
8. Disconnect the oil cooler hose from the oil cooler pipe.
9. Remove the air cleaner hose, cap and case assembly.
10. Disconnect the cruise control actuator cable from the throttle body.
11. Disconnect the accelerator actuator cable from the throttle body.
12. Disconnect the heater hoses.
13. Disconnect the ground wire and heater control valve from the cowl panel.
14. Remove the brake booster vacuum hose.
15. Disconnect the evaporative emissions (EVAP) hoses and fuel hoses.

⁂CAUTION

Fuel injected engines remain under constant pressure after the ignition has been turned OFF. Properly relieve the pressure before disconnecting any fuel lines. Failure to do so may result in personal injury.

16. Disconnect the following wires and connectors:
    - The two heated oxygen sensors
    - DCL1 clamp
    - Oil pressure gauge connections
    - Alternator wire and connector
    - Intake manifold from the fender apron connection
    - High tension cord leading to the ignition coil
    - Ground strap from the No. 1 engine hanger
    - Ground strap from the air intake chamber
    - Ground cable from the cylinder block
17. Loosen the idler pulley nut and adjusting nut to remove the A/C drive belt.
18. Disconnect the A/C compressor, then remove the bracket.
19. Remove the radiator pipe as follows:
    a. Remove the two nuts retaining the radiator pipe to the No. 1 oil pan.
    b. Disconnect the No. 2 radiator hose from the water inlet, then remove the radiator pipe.
20. Remove the union bolt and the two gaskets, then disconnect the pressure hose from the power steering reservoir pump.
21. Disconnect the return hose from the power steering reservoir tank.

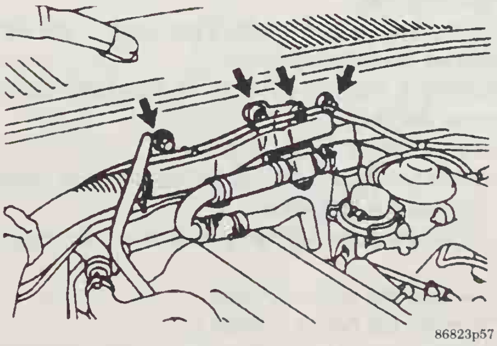

Fig. 39 Remove the bolts securing the engine ground wire and heater control valve

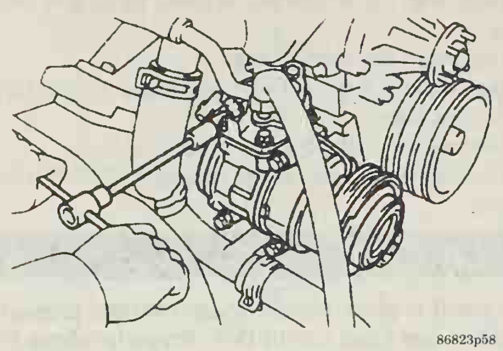

Fig. 40 Remove the bolts securing the compressor, then position it aside

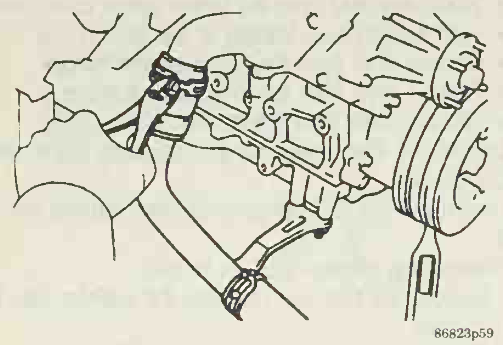

Fig. 41 Disconnect the No. 2 radiator hose from the water inlet

22. Remove the glove compartment door.
23. Remove the speaker panel.
24. Disconnect the A/C amplifier.
25. Disconnect the wire leading to the Electronic Control Unit (ECU) and cowl wire.
26. Pull out the engine wire out from the cabin of the vehicle.
27. Remove the stabilizer bar.
28. Matchmark the flanges of the front and rear driveshafts, then remove the shafts.
29. Remove the transfer shift lever.
    a. Remove the nut retaining the transmission control rod.
    b. Remove the shift knob.
    c. Lift up the console slightly in order to disconnect the wire.
    d. Remove the shifter console.
    e. Remove the center console box.
    f. Disconnect the wires, then remove the transfer shift lever boot and lever assembly.
    g. Pull out the retaining pin, then disconnect the shift rod.
    h. Remove the hose clamp, then the transfer shift lever.

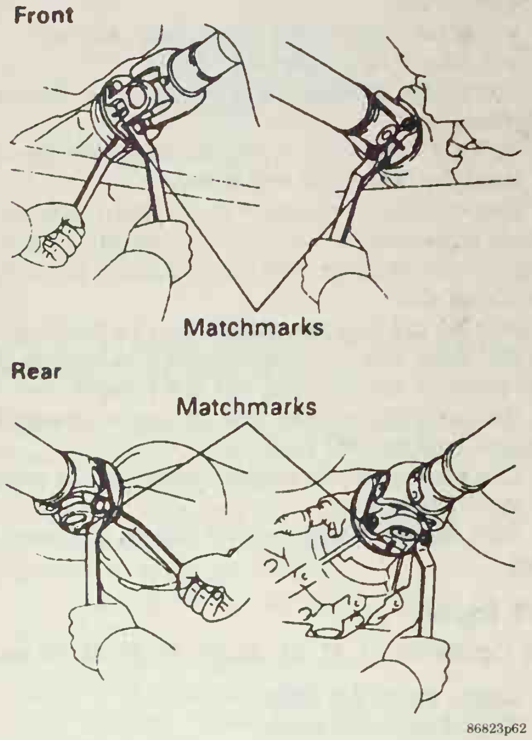

Fig. 42 Always matchmark the driveshaft flanges prior to removal

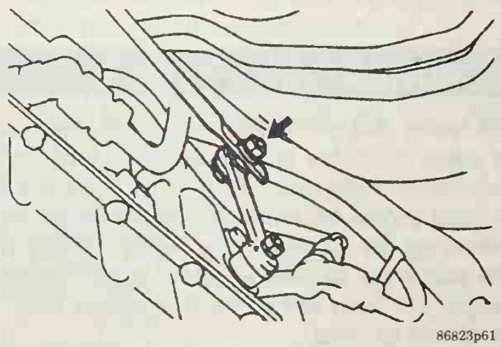

Fig. 43 Remove this nut to release the control rod

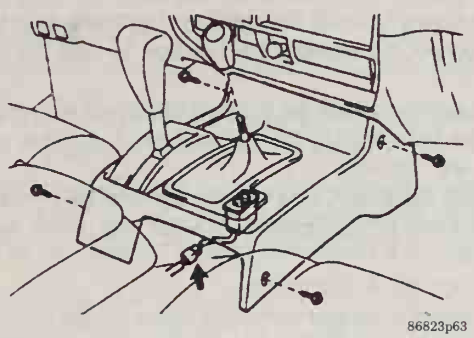

Fig. 44 Remove the screws securing the shifter console, then detach the wiring

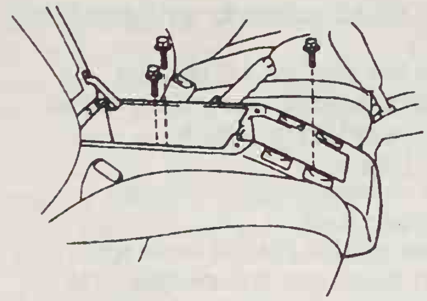

Fig. 45 The center console should also be removed

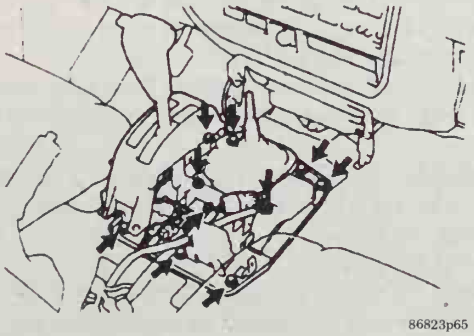

Fig. 46 Bolt locations for removing the shift lever assembly

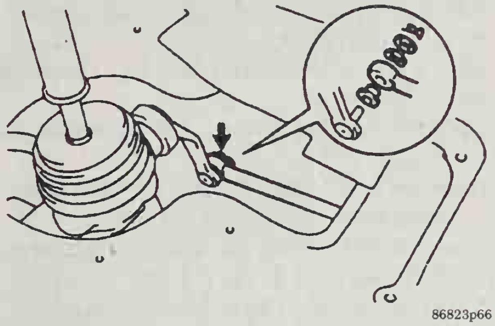

Fig. 47 Assemble the washers for the shift rod linkage as shown

30. Remove the front exhaust pipe.
    a. Disconnect the heated oxygen sensor.
    b. Remove the nuts and bolts holding the exhaust to the catalyst.
    c. Loosen the clamp then disconnect the from the No. 1 support bracket.
    d. Remove the No. 1 support bracket.
    e. Remove the front exhaust pipe.
31. Detach the ground strap from the heat insulator.
32. Place a jack under the transmission. Put a wooden block between the jack and the transmission oil pan to prevent damages to the pan.
33. Remove the frame crossmember.
34. Attach the engine hoist chain to the two engine hangers.
35. Remove the nuts holding the engine front mounting insulators to the frame.
36. Lift the engine with the transmission out of the vehicle slowly and carefully. Make certain the engine is clear of all wiring and hoses.

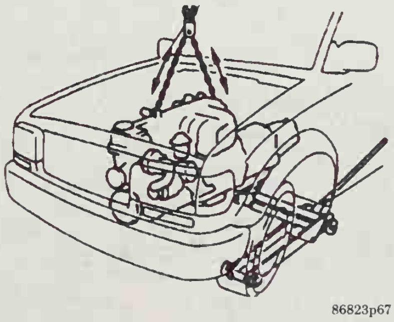

Fig. 48 Secure the engine hoist chain to the engine as shown

To install:

37. Attach the engine hoist chain to the engine hangers, then lower the engine and transmission into the vehicle.

38. Install the nuts holding the engine front mounting insulators to the frame crossmember.

39. Keep the engine level with a jack, then remove the chain hoist.

40. Install the front crossmember, then tighten the bolts to 45 ft. lbs. (61 Nm).

41. Tighten the nuts holding the crossmember to the engine rear mounting insulator to 54 ft. lbs. (74 Nm).

42. Tighten the nuts holding the engine front mounting insulators to the frame to 54 ft. lbs. (74 Nm).

43. Connect the ground strap to the heat insulator.

44. Install the front exhaust pipe, then tighten the nuts to 46 ft. lbs. (63 Nm).

  a. Install the No. 1 support bracket, then tighten the bolts to 17 ft. lbs. (24 Nm).

  b. Connect the clamp and tighten to 14 ft. lbs. (19 Nm).

  c. Connect the front exhaust pipe to the rear catalyst, tighten the bolts to 34 ft. lbs. (46 Nm).

45. Install the transfer shift lever and hose clamp, tighten the bolts to 13 ft. lbs. (18 Nm).

  a. Connect the shift rod and install the pin.

  b. Install the transfer shift lever boot, transmission shift lever assembly and tighten the bolts to 4 ft. lbs. (5 Nm).

  c. Attach the connectors to the shift lever assembly.

  d. Install the center console box.

  e. Connect the pattern select switch.

  f. Install the shifter console and shift lever knob.

  g. Shift the lever into the neutral (N) position.

  h. Fully turn the control shaft lever back and return two notches. It will now be in the neutral (N) position.

  i. Connect the transmission control rod and tighten to 9 ft. lbs. (13 Nm).

46. Install the front and rear driveshafts.

  a. On the differential side, align the matchmarks on the flanges, then tighten the front shaft to 54 ft. lbs. (74 Nm), and the rear shaft to 65 ft. lbs. (88 Nm).

  b. On the transfer side, align the matchmarks on the flanges, then tighten the front shaft to 54 ft. lbs. (74 Nm), and the rear shaft to 65 ft. lbs. (88 Nm).

47. Temporarily install the stabilizer bar to the axle housing.

48. Connect the stabilizer bar brackets to 13 ft. lbs. (18 Nm).

49. Lower the vehicle so that it is resting on its suspension, tighten the bolts holding the stabilizer bar to the axle housing to 19 ft. lbs. (25 Nm).

50. Push the engine wire through the cowl panel and connect the wiring to the Electronic Control Unit (ECU) and the cowl wire.

51. Attach the A/C amplifier.

52. Install the speaker panel and glove compartment door.

53. Connect the return hose to the power steering reservoir tank.

54. Connect the power steering pressure hose with the union bolt and tighten to 42 ft. lbs. (56 Nm).

55. Install the radiator pipe as follows:

  a. Connect the No. 2 radiator hose to the water inlet.

  b. Install the two nuts holding the radiator pipe to the No. 1 oil pan. Tighten the nuts to 15 ft. lbs. (21 Nm).

56. Install the A/C bracket and tighten the bolts to 27 ft. lbs. (37 Nm).

57. Install the A/C compressor and tighten to bolts to 18 ft. lbs. (25 Nm).

58. Install and adjust the A/C drive belt.

59. Install the following wires and connections:

  a. Two heated oxygen sensors
  b. DCL1 clamp
  c. Low oil pressure gauge connectors
  d. Alternator wires
  e. Intake manifold from the fender apron
  f. High tension cord from the ignition coil
  g. Ground strap from the No. 1 engine hanger
  h. Ground strap from the air intake chamber
  i. Starter wire
  j. Ground cable from the cylinder block

60. Connect the fuel inlet hose to the fuel filter and tighten the union bolt to 22 ft. lbs. (39 Nm). Connect the fuel return line.

61. Connect the evaporative emissions (EVAP) hose and brake booster vacuum hose.

62. Connect the heater control valve and the engine wire to the cowl panel. Connect the engine wire and the ground strap.

63. Connect the heater hoses.

64. Connect the accelerator cable to the throttle body.

65. Connect the cruise control actuator cable to the throttle body.

66. Install the air cleaner case, the hose and the cap.

67. Connect the oil cooler hose to oil cooler pipe.

68. Install the radiator.

69. Install the grille.

70. Install the battery tray and battery. Connect the cable.

71. Fill the engine with oil and the transmission with proper amount and type of fluid.

72. Fill the cooling system with coolant.

73. Start the engine and check for leaks.

74. Check the automatic transmission fluid level.

75. Check the timing.

76. Install the hood and test drive the vehicle.

77. Top off any fluid levels.

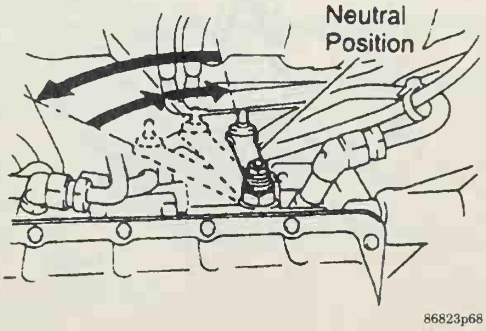

Fig. 49 The shift lever must be placed in the neutral position

Rocker Arm (Valve) Cover

REMOVAL & INSTALLATION

Check the hoses, wiring, bolt threads and any other part that could be damaged or worn replace if needed.

➡Apply a lubricant onto any nuts or bolts that will be removed. Allow the lubricant to sit for a short while. This will aid in the removal of tight and frozen nuts and bolts.

22R, 22R-E and 3F-E Engines

➧ See Figures 50, 51, 52, 53, 54 and 55

1. Disconnect the negative battery cable.
2. On 22R and 22R-E engines, remove the ground strap from the valve cover.
3. On 3F-E, remove the air cleaner hose.
4. Disconnect the PCV hose(s) from the cam cover.
5. Remove the nuts and washers. Lift the cover off the cylinder head. Cover the oil return hole in the head to prevent dirt or objects from falling in. Remove the gasket.

To install:

6. Replace the rubber half moon seals in the cylinder head if they seem to be deteriorated.
7. Replace the cover gasket if it shows any signs of damage, breaks or cracking. Install new nut gaskets, then tighten the nuts evenly to 43-48 inch lbs (4-5 Nm) for four cylinder engines and 78 inch lbs. (9 Nm) for six cylinder engines. Do not overtighten.
8. Reconnect the PCV hose and install the air cleaner hose or ground strap.

3VZ-E Engine

➧ See Figures 56, 57, 58, 59 and 60

1. Disconnect the throttle position sensor.
2. Unsecure the canister vacuum hose from the throttle body.

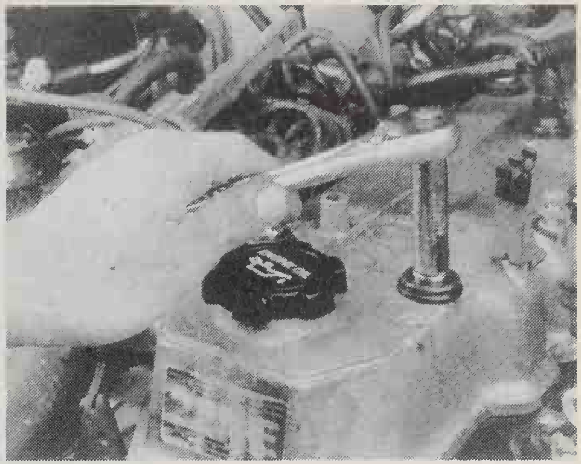
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Fig. 51 It may be necessary to use a deep socket to remove the retaining nuts

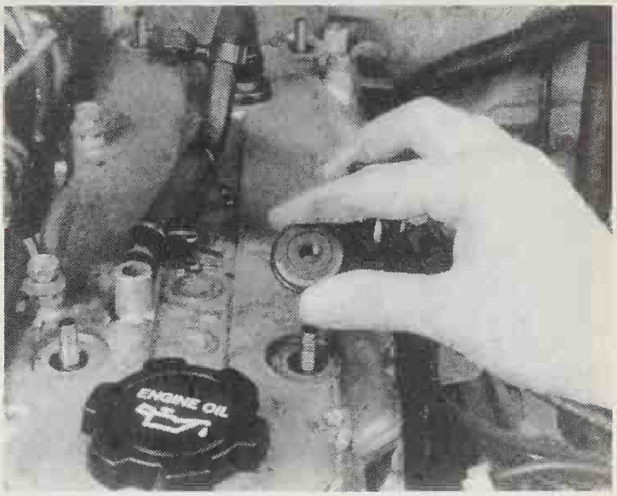

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Fig. 52 Be careful not to lose the seal washers

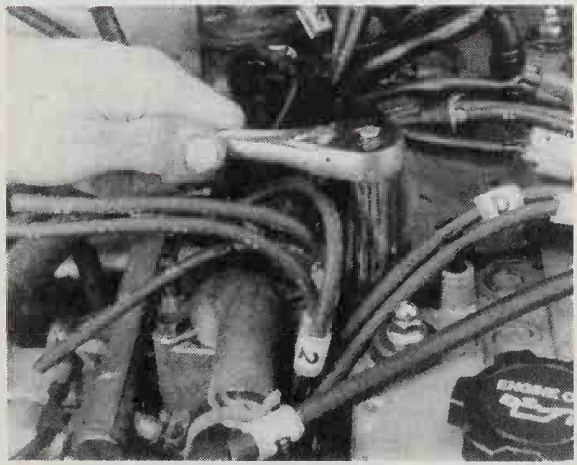
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Fig. 50 Remove the bolt securing the ground strap to the valve cover

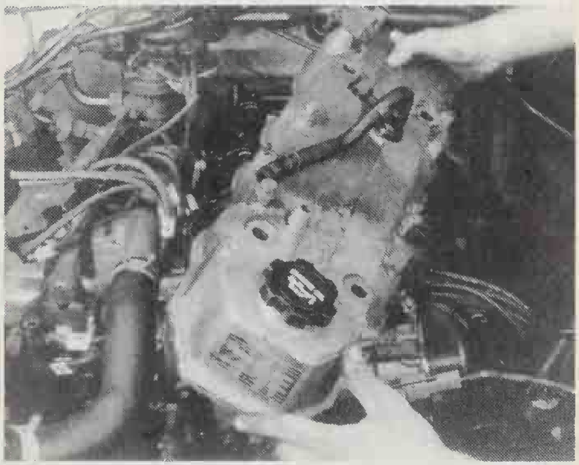
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Fig. 53 Once the retaining nuts are removed, lift the cover from the head. . .

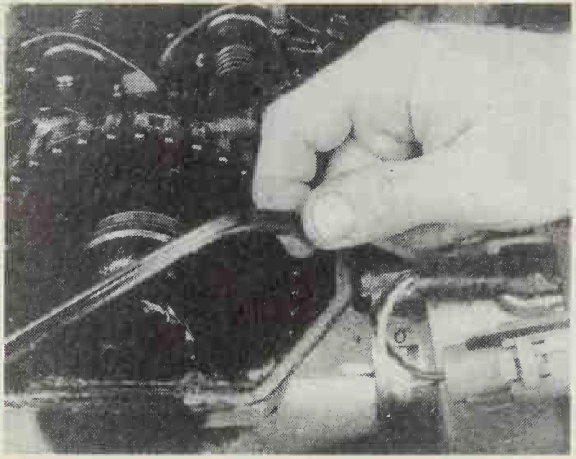


Fig. 54 . . . then pull the rubber gasket off the head mating area

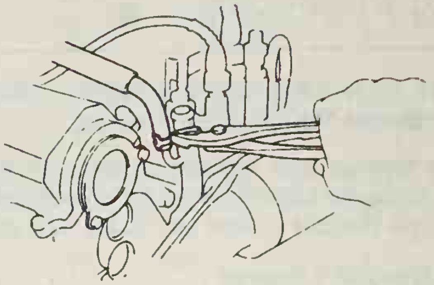


Fig. 56 Disconnect the hose from cold start injector pipe

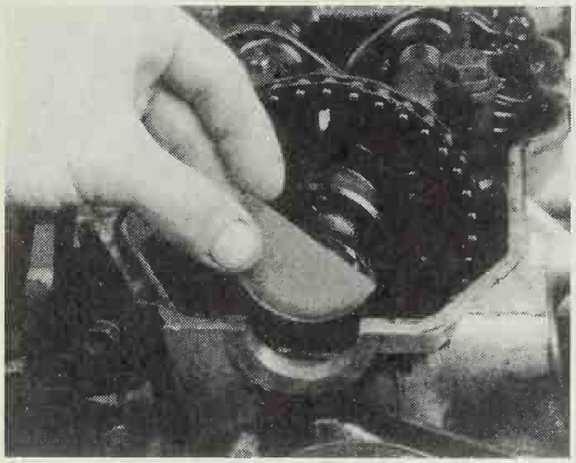


Fig. 55 Inspect the half moon seals, replace if deteriorated

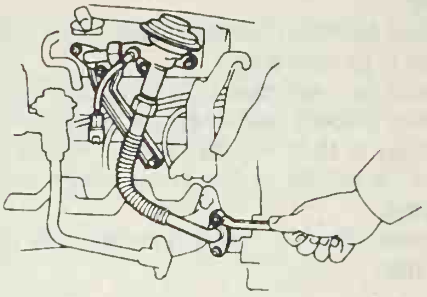


Fig. 57 Remove the bolts securing the EGR assembly to the engine

3. Take off the vacuum and fuel hoses from the pressure regulator.
4. Disconnect PCV hose from the hose union.
5. Remove the water bypass hose from the union at the intake manifold.
6. Disconnect the cold start injector connector.
7. Take off the vacuum hose from the fuel filter.
8. Remove the union bolt and the two gaskets and the cold start injector tube.
9. On California vehicles, disconnect the EGR temperature sensor connector.
10. Disconnect the EGR vacuum hoses from the air pipe and EGR vacuum modulator.
11. Remove the nut, bolt and intake manifold stay (support).
12. Disconnect the 2 water bypass hoses from the EGR valve.
13. Remove the 5 nuts and remove the EGR valve with the pipes and 2 gaskets.
14. Remove the 6 bolts and 2 nuts holding the intake manifold; remove the gasket.
15. Disconnect and label the following wires:

- Knock sensor connector
- Water temperature switch connector
- Start injection timer
- Water temperature sensor connector
- Water temperature sender gauge connector
- Right side engine ground strap
- Injector connector

16. Remove the two bolts holding the engine wire harness and remove the harness.
17. Remove the bolts holding the valve cover(s); remove the cover(s) and gaskets.

To install:

18. Examine the gasket closely for any sign of cracking or deformation. Replace the gasket if necessary.
19. Place the gasket on the cover. Apply sealant at the 4 corners of each head as shown in the illustration. Do not apply sealant to the entire gasket.

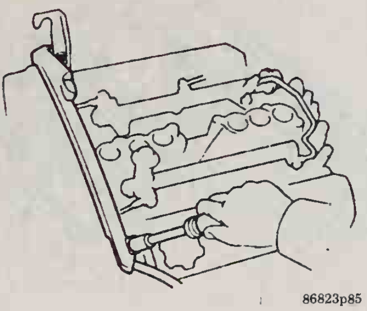


Fig. 58 Remove the two bolts retaining the engine harness in place

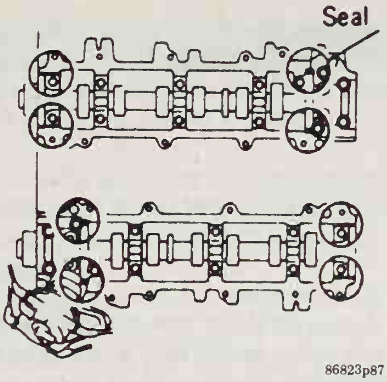


Fig. 59 Sealant must be applied to the four corners of each head as shown

20. Place the valve cover and gaskets in place on the head and install the small retaining bolts. Tighten them evenly only to 5-6 ft. lbs. (7-8 Nm), do not overtighten.
21. Install the engine wire harness with its two bolts. Engage all the connectors disconnected in Step 17.
22. Position a new gasket on the intake manifold. Install the manifold, tightening the six bolts and two nuts to 13 ft. lbs. (18 Nm).
23. Connect the No.1 air hose to the reed valve.
24. Install two new gaskets to the intake manifold and right side exhaust manifold. Install the EGR valve and pipes.
25. Install the two water bypass hoses to the EGR if so equipped.
26. Install the intake manifold support; tighten the groups of bolts to the proper torque — refer to the diagram for designations. Group (A) bolts should be tightened to 9 ft. lbs. (12 Nm), group (B) to 13 ft. lbs. (18 Nm) and group (C) bolts to 22 ft. lbs. (29 Nm).
27. Connect the EGR hoses to the air pipe and the EGR vacuum modulator. For California vehicles, connect the EGR temperature sensor connector.
28. Use a new gasket and connect the cold start injector tube. Tighten the union bolt to 13 ft. lbs. (18 Nm).
29. Connect the vacuum hose to the fuel filter, then connect the cold start injector connector.
30. Install the 2 water bypass hoses, one to the bypass pipe and the other to the hose union.
31. Connect the PCV hose to the hose union.
32. Connect the vacuum and fuel hoses to the pressure regulator.
33. Connect the canister vacuum hose to the throttle body.
34. Connect the throttle position sensor wire.

2RZ-FE and 3RZ-FE Engines

➧ See Figure 61

1. Drain the coolant from the engine.
2. On manual transmissions, disconnect the accelerator cable from the throttle body.
3. On automatics, disconnect the accelerator and throttle cables from the throttle body.
4. On cruise control, remove the actuator cover, then disconnect the cruise control cable from the actuator.
5. Disconnect the 3 wire clamps for the engine harness.
6. Unsecure the Mass Air Flow (MAF) meter and Intake Air Temperature (IAT) sensor connections.
7. On the 3RZ-FE engine, disconnect the air hose from the air cleaner cap, then loosen the air cleaner hose clamp.
8. Loosen the 4 clips, and remove the the cleaner cap, Mass Air Flow (MAF) meter and resonator sensor.
9. Remove the air intake sensor by disconnecting the air hose for the Idle Air Control (IAC).
   a. Remove the vacuum sensing hose and wire clamp for the engine wire.
   b. Loosen the hose clamp, and remove the bolts retaining the air intake connector.
10. Remove the PCV hoses.
11. Tag and disconnect the spark plug wires.

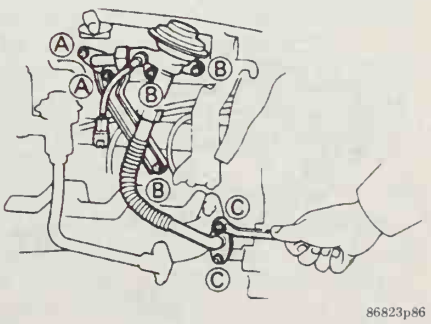


Fig. 60 Bolt group designations

12. Disconnect these wires:
    - A/C connector if equipped
    - Oil pressure sensor wire
    - Engine coolant temperature sensor
    - Distributor wire
    - 4 engine wire clamps and engine wire

13. Remove the valve cover bolts, seal washers, cover and gasket.

To install:

14. Clean the mating areas well.
15. Install the gasket on the cover, then install the cover to the cylinder head. Be sure to have new seal washers, then install the bolts and tighten to the correct specification.
16. Attach the wire removed previously.
17. Install the spark plug wires.
18. Reattach the PCV hoses.
19. Install the air intake chamber.
20. Fill the with a coolant and water mixture.
21. Start the engine and check for leaks. Top off any fluid levels.

5VZ-FE Engine

➧ See Figure 62

1. Disconnect the accelerator and throttle cables from the throttle linkage.
2. Remove the air cleaner cover, air flow meter, and air duct assembly. It will be necessary to disconnect the wiring to the meter and unbolt the assembly, prior to removal.
3. Loosen and remove the valve cover bolts.
4. Remove the valve covers, work on one at a time to avoid confusion.

To install:

5. Clean the mating areas on the cover and cylinder head.
6. Install the gasket to the head and seal washers. Attach the cover with the mounting bolts. Tighten until snug.
7. Install the air flow meter, air duct, and the air cleaner cover.
8. Connect the accelerator and throttle cables to the throttle linkage.

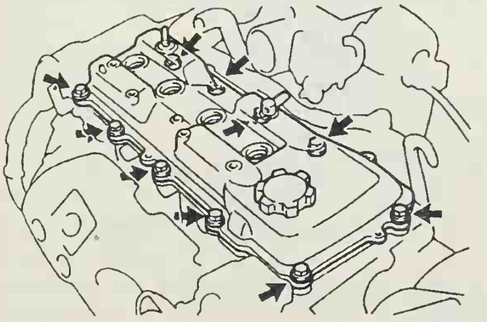


Fig. 61 On 2RZ-FE and 3RZ-FE engines, the valve cover is secured by 10 bolts

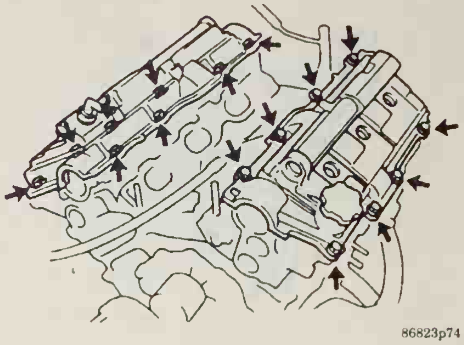


Fig. 62 The valve covers are secured to the heads by the bolts shown on 5VZ-FE engines

1FZ-FE Engine

➧ See Figures 63 and 64

1. Drain the cooling system.
2. Remove the throttle body.
3. Disconnect the engine wiring harness and heater control valve from the cowl panel. A ground strap holds the harness in place.
4. Tag and disconnect the spark plug wires.
5. Remove the cylinder head (valve) cover bolts, gasket and cover.

To install:

6. Clean the valve cover and mating areas on the engine.
7. Install a new gasket into the groove of the cover.
8. Install and tighten the 13 bolts on the valve cover to the correct specifications.
9. Attach the spark plug wires to there proper locations.
10. Bolt the engine harness to the cowl. Attach the heater control valve.
11. Install the throttle body with a new gasket.
12. Fill the cooling system.

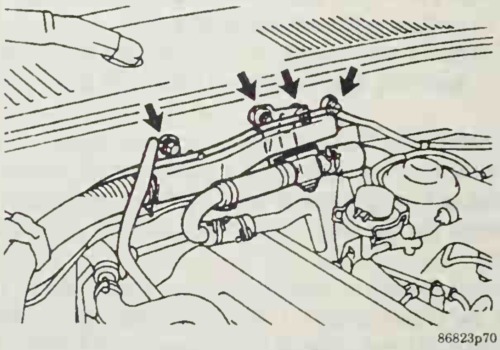


Fig. 63 Remove the bolts securing the harness ground strap and heater valve to the cowl panel

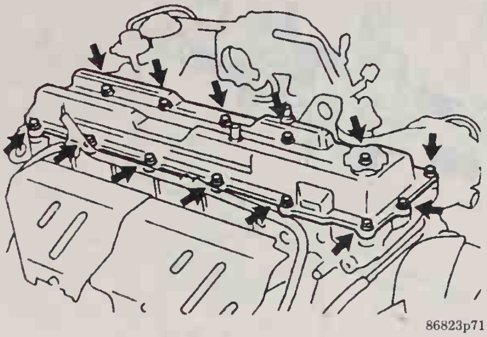


Fig. 64 The valve cover on 1FZ-FE engines is secured by 13 bolts

13. Start the engine and check for leaks. Top off any fluid levels.

Rocker Arm/Shafts

REMOVAL & INSTALLATION

➡Only the 22R, 22R-E and 3F-E engines use rocker arms. Other engines operate the valves through the direct action of the camshaft.

22R and 22R-E Engines

➧ See Figures 65, 66, 67, 68 and 69

⁂WARNING

The rocker shaft assembly is held by the head bolts. Removal of the head to replace the head gasket is REQUIRED any time the head bolts are loosened. Refer to cylinder head removal and installation later in this section. NEVER attempt to re-compress the same gasket after the head bolts are loosened.

1. Remove the valve cover. The head bolts must be loosened in the correct order to avoid head damage. Refer to the cylinder head removal and installation procedure in this section. Once the bolts are loosened and removed, carefully remove the rocker shaft assembly.

➡It may be necessary to use gentle prying force at the ends of the assembly to lift it off the head. Do not damage the head during removal.

2. Remove the three retaining screws and slide the rocker supports, springs and rocker arms off of the shafts. Keep all parts in order; the shafts must be reassembled in the correct order.
3. Inspect the rocker arm-to-shaft wear by wiggling the arm laterally on the shaft. Little or no movement should be felt.
4. If movement is found in the arm-to-shaft wiggle test, measure the oil clearance as follows:
    a. Measure the outside diameter of the rocker shaft with a micrometer.
    b. Measure the inside diameter of the rocker arms with a dial indicator.
    c. The difference between the rocker arm inner diameter and the shaft outer diameter is the oil clearance. Correct clearance is 0.0004-0.0020 inches (0.01-0.05 mm). Maximum allowable clearance is 0.0031 inches (0.08 mm).
5. Inspect the face of each rocker; the surface should be smooth, shiny and evenly shaped. Any sign of metal wear or scratching requires replacement of the rocker and a detailed inspection of the camshaft.

➡The condition of the rocker surfaces and matching camshaft lobes are your report card for oil and filter changes. If you have been less than prompt about performing routine oil changes, chances are good that the rockers and/or cam lobes are scored or damaged from poor oiling. The amount of sludge in the head is also a good indicator of poor oil change frequency.

6. Reassemble the rocker shafts, arms and towers in their exact original order.
7. Remove the head, install a new gasket. See cylinder head removal and installation. Install the rocker assembly and tighten the bolts gradually and in sequence to 58 ft. lbs. (78 Nm).
8. Adjust the valve clearance. Install the valve cover.
9. Test drive the vehicle.

3F-E Engine

➧ See Figures 70, 71 and 72

1. Remove the valve cover.
2. The rocker assembly is held by 8 bolts and 4 nuts. These must be loosened evenly in several passes. Do not loosen any one fastener all at once. Loosen the nuts and bolts in the correct order.
3. Inspect the rocker arm-to-shaft wear by wiggling the arm laterally on the shaft. Little or no movement should be felt.
4. If movement is found in the arm-to-shaft wiggle test, disassemble the shaft and keep every piece in exact order. Measure the oil clearance as follows:
    a. Measure the outside diameter of the rocker shaft with a micrometer.
    b. Measure the inside diameter of the rocker arms with a dial indicator.
    c. The difference between the rocker arm inner diameter and the shaft outer diameter is the oil clearance. Correct clearance is 0.0004-0.0020 inches (0.01-0.05 mm). Maximum allowable clearance is 0.0031 inches (0.08 mm).
5. Inspect the face of each rocker; the surface should be smooth, shiny and evenly shaped. Any sign of metal wear or scratching requires replacement of the rocker and a detailed inspection of the camshaft.

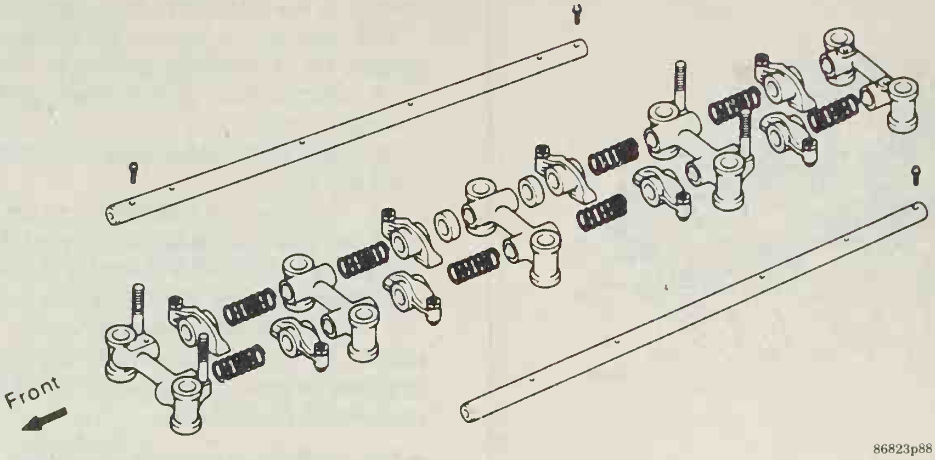

Front
86823p88

Fig. 65 Exploded view of the 22R and 22R-E rocker arms and shafts

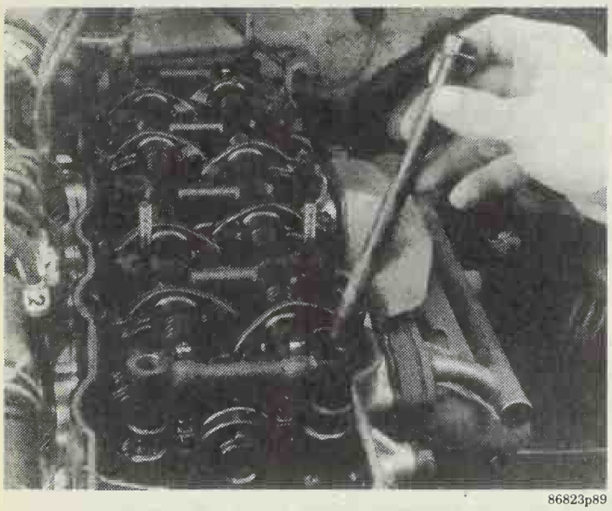


Fig. 66 After the head bolts are removed . . .

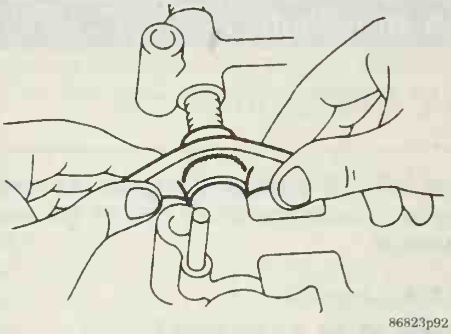


Fig. 68 Wiggle the rocker arm on the shaft to check for excessive free-play

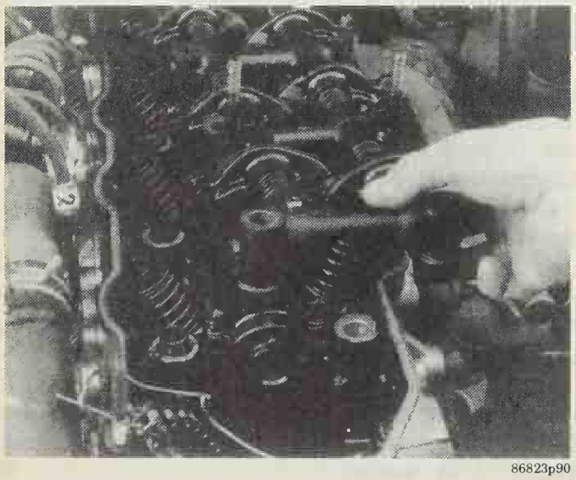


Fig. 67 . . . the rocker shaft assembly can be lifted from the head

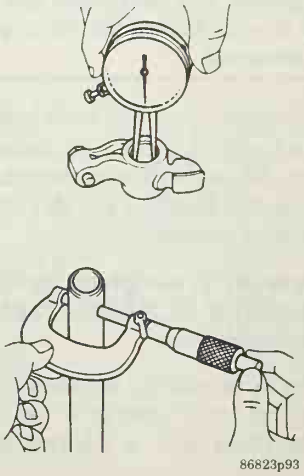


Fig. 69 Measure the rocker inner diameter and the shaft outer diameter to determine the oil clearance

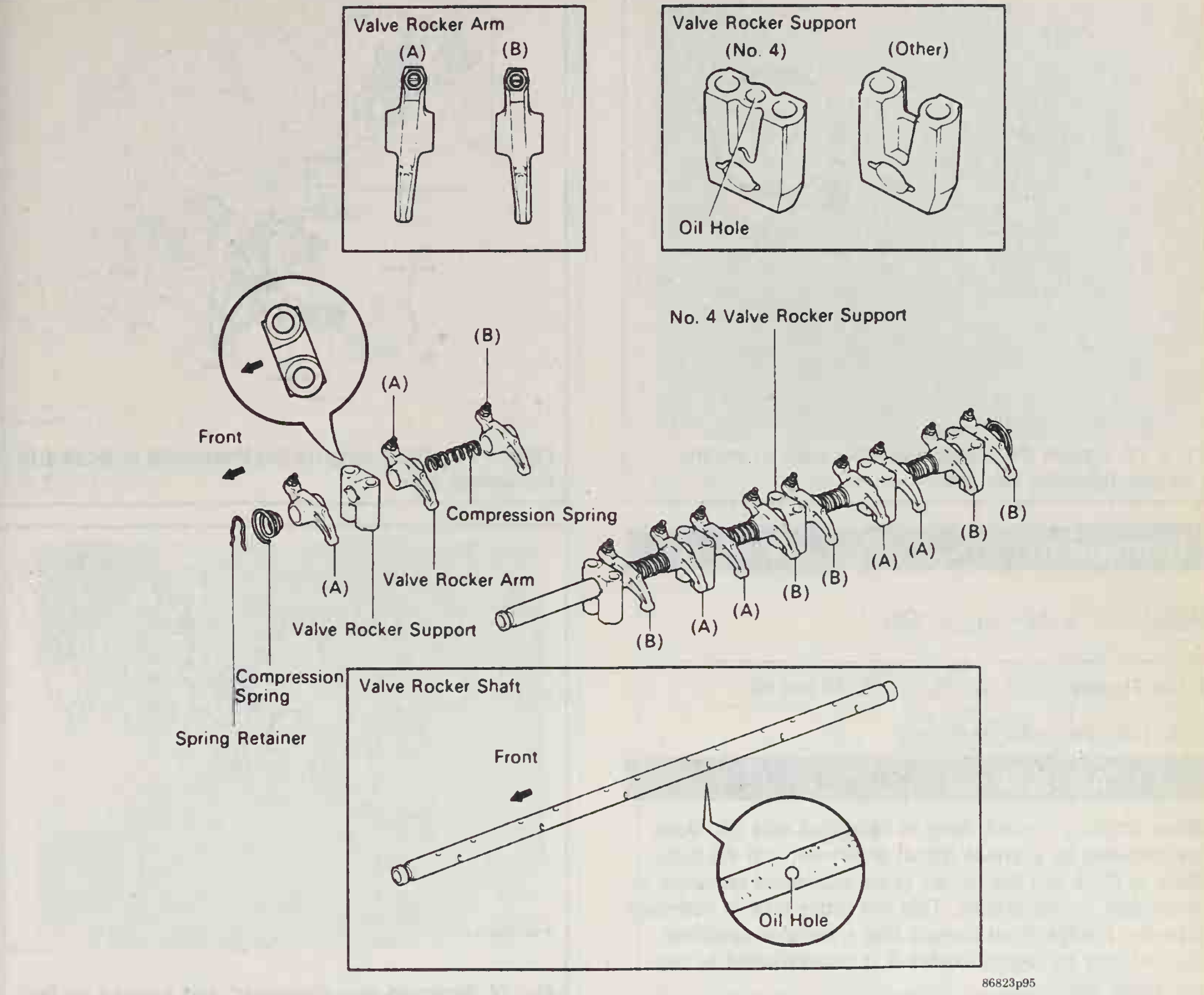

Valve Rocker Arm
(A)
(B)
Valve Rocker Support
(No. 4)
(Other)
Oil Hole
No. 4 Valve Rocker Support
(B)
(A)
Front
Compression Spring
Valve Rocker Arm
(A)
Valve Rocker Support
Compression Spring
Spring Retainer
(B)
(A)
(A)
(B)
(B)
(A)
(A)
(B)
(B)
Valve Rocker Shaft
Front
Oil Hole
86823p95

Fig. 70 Exploded view of the rocker shaft assembly on the 3F-E engine

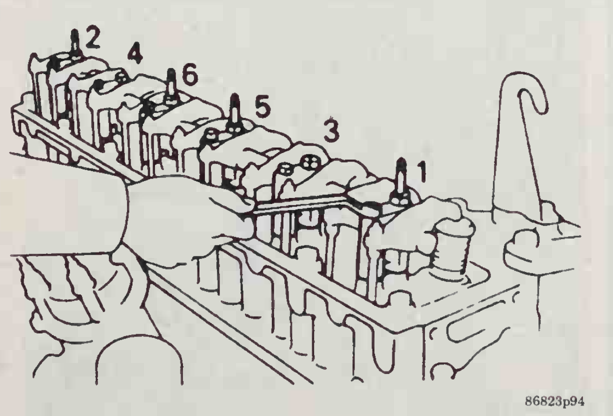

2
4
6
5
3
1
86823p94

Fig. 71 Loosen the rocker assembly bolts in several passes in this order

6. Remove the cylinder head.

➡The condition of the rocker surfaces and matching camshaft lobes are your report card for oil and filter changes. If you have been less than prompt about performing routine oil changes, chances are good that the rockers and/or cam lobes are scored or damaged from poor oiling. The amount of sludge in the head is also a good indicator of poor oil change frequency.

To install:

7. Install the cylinder head with a new gasket. Reassemble the rocker shafts, arms and towers in their exact original order.
8. Place the rocker shaft assembly on the cylinder head. Align the adjusting screws with the heads of the pushrods.
9. Install the retaining bolts. Tighten them in the correct order and in several passes to the correct torque. The 12 mm bolt heads should be tightened to 15-17 ft. lbs. (21-24 Nm). The 14 mm bolt head and the nut should be tightened to 25 ft. lbs. (33 Nm).
10. Adjust the valve clearance. Reinstall the valve cover.

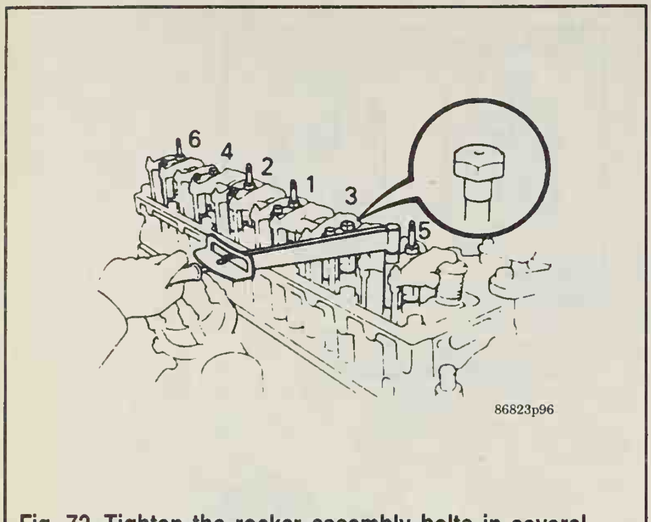

6
4
2
1
3
5
86823p96

Fig. 72 Tighten the rocker assembly bolts in several passes following this order

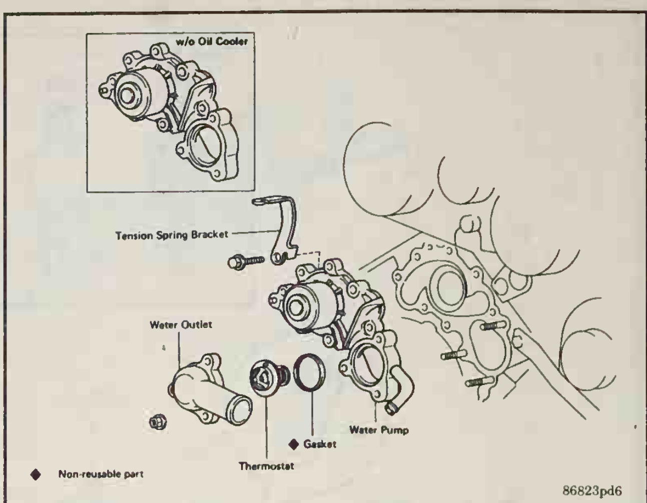

w/o Oil Cooler
Tension Spring Bracket
Water Outlet
Water Pump
◆ Gasket
Thermostat
◆ Non-reusable part
86823pd6

Fig. 73 On, 3VZ-E engines the thermostat is located in the waterpump

Thermostat

REMOVAL & INSTALLATION

See Figures 73, 74, 75, 76, 77, 78, 79 and 80

1. Drain the cooling system.

**CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

2. On 3F-E engines, disconnect the 2 vacuum hoses from the Bimetal Vacuum Switching Valve (BVSV), the cold start injector time switch wire and the water temperature switch connector.
3. Unbolt the housing, then remove the water inlet with the hose attached. If there is not enough room to pull both housing and hose out, you may want to disconnect the hose first. On 3F-E engines, remove the clamp bolt for the ISC water bypass pipe. Make certain to remove the gasket with the water inlet. Some of it will probably stick to the housing and require scraping.
4. Remove the thermostat.

To install:

5. When installing a new thermostat always use a new gasket. Be sure that the thermostat is positioned with the spring down or into the housing. On 3VZ-E engines, the jiggle valve (looks like a small rivet in the edge of the thermostat) must be at the top or 12 o'clock position.
6. Install the water inlet. Install the bolts finger-tight until the inlet is positioned exactly. Tighten the bolts to 10-14 ft. lbs. (13-19 Nm). Overtightening will break the ear off the housing and spoil your afternoon — don't do it.

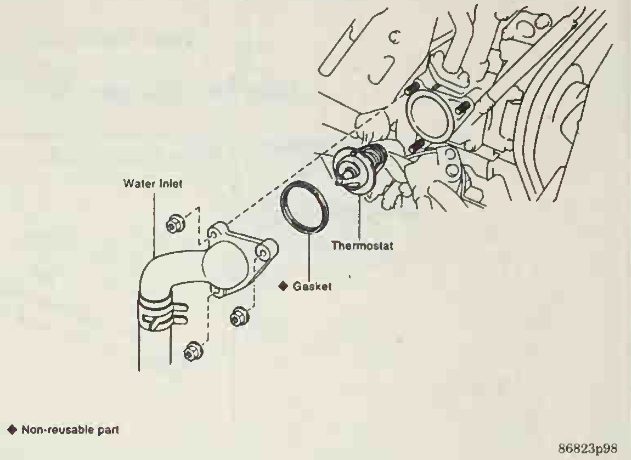

Water Inlet
Thermostat
◆ Gasket
◆ Non-reusable part
86823p98

Fig. 74 Exploded view thermostat and housing on the 1FZ-FE engine

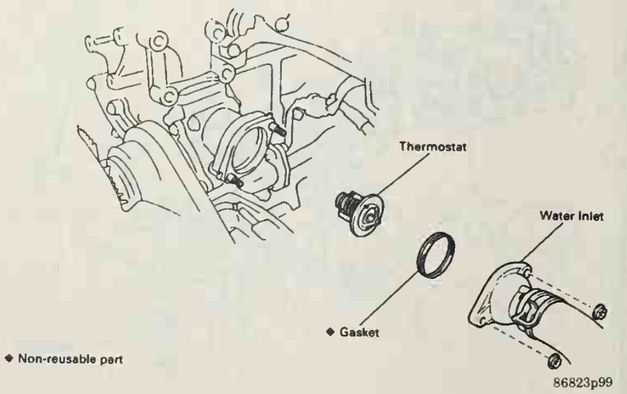

Thermostat
Water Inlet
◆ Gasket
◆ Non-reusable part
86823p99

Fig. 75 Exploded view thermostat and housing on the 2RZ-FE and 3RZ-FE engines

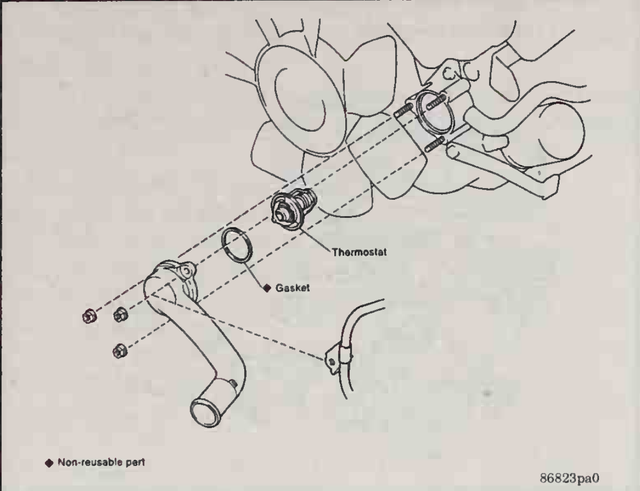

Thermostat
◆ Gasket
◆ Non-reusable part
86823pa0

Fig. 76 Exploded view thermostat and housing on the 5VZ-FE engine

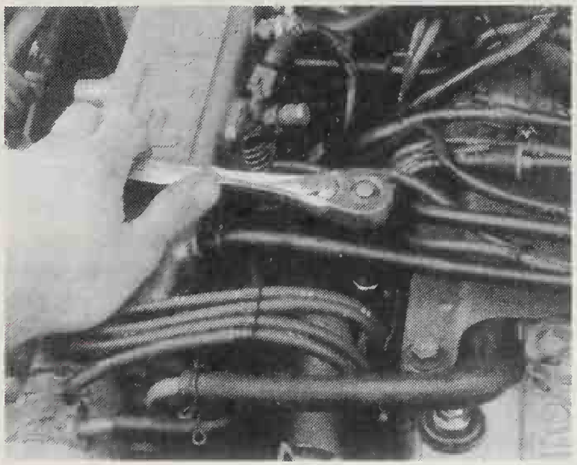


Fig. 77 An extension is helpful for reaching the housing retainers

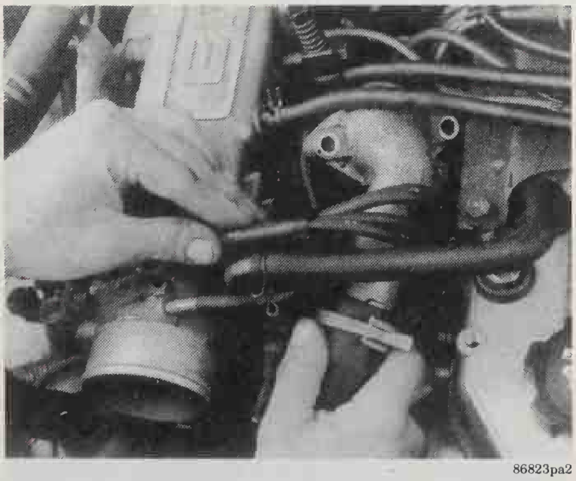


Fig. 78 You may need to maneuver the housing through other hoses in the way

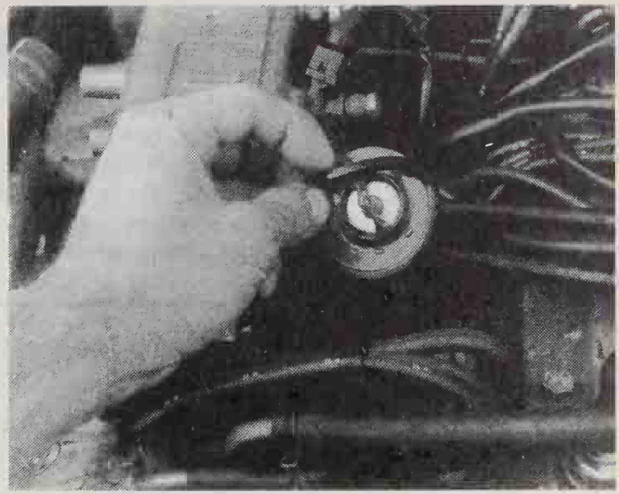


Fig. 79 Lift the thermostat and gasket from the inlet

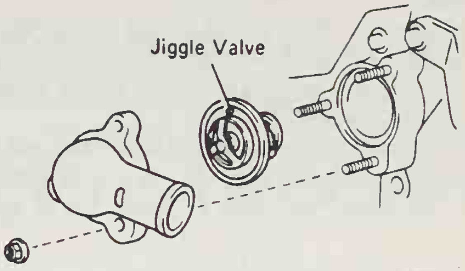

Jiggle Valve
86823pb6

Fig. 80 If used, the thermostat must be installed with the jiggle valve at the top

7. Install the hoses and wire connectors removed for access. Make certain the coolant hoses are not kinked or twisted after installation. Do not overtighten the hose clamps.

8. Fill the cooling system with coolant.

9. Start the engine and check for leaks. Top off any fluid levels.

Intake Manifold

REMOVAL & INSTALLATION

22R Engines

1. Disconnect the negative battery cable first.

2. Drain the cooling system.

✻✻CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Remove the air cleaner assembly, complete with hoses, from the carburetor.
4. Label and disconnect the vacuum lines from the EGR valve and carburetor. Disconnect the EGR pipe from the manifold; remove the EGR valve with the pipe attached.
5. Remove the fuel lines, electrical leads, accelerator linkage, and water hose from the carburetor.
6. Remove the water bypass hose from the manifold.
7. Unbolt and remove the intake manifold, complete with carburetor and EGR valve.
8. Cover the cylinder head ports with clean shop cloths to keep anything from falling into the cylinder head or block.

To install:

9. When installing the manifold, always replace the gasket with a new one. Tighten the mounting nuts and bolts to 14 ft. lbs. (19 Nm). Tighten the bolts in several stages working from the inside bolts outward.
10. Connect the bypass line and all other lines and hoses.
11. Install the air cleaner and refill the cooling system.
12. Start the engine and check for leaks. Top off any fluid levels.

22R-E Engines

➧ See Figures 81 and 82

1. Disconnect the negative battery cable.
2. Drain the cooling system.

✻✻CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Disconnect the air intake hose from both the air cleaner assembly on one end and the air intake chamber on the other.
4. Tag and disconnect all vacuum lines attached to the intake chamber and manifold.
5. Tag and disconnect the wires to the cold start injector, throttle position sensor, and the water hoses from the throttle body.
6. Remove the EGR valve from the intake chamber.
7. Tag and disconnect the actuator cable, accelerator cable and automatic transmission throttle cable (if equipped) from the cable bracket on the intake chamber.
8. Unbolt the air intake chamber from the intake manifold and remove the chamber with the throttle body attached.

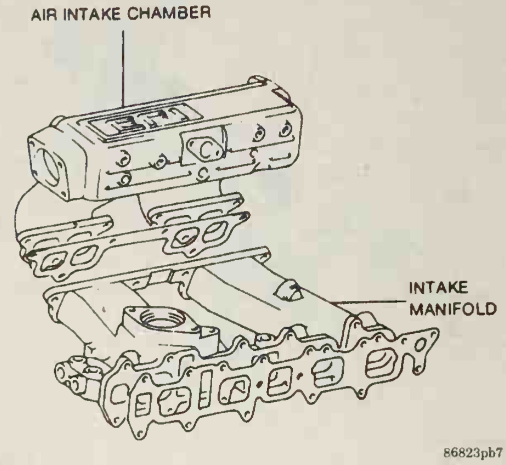


Fig. 81 Exploded view of the intake manifold and air intake chamber on the 22R-E engine

9. Disconnect the fuel hose from the fuel delivery pipe.
10. Disconnect the air valve hose from the intake manifold.
11. Make sure all hoses, lines and wires are tagged for later installation and disconnected from the intake manifold. Unbolt the air intake chamber from the intake manifold.
12. Unbolt the manifold from the cylinder head, removing the delivery pipe and injection nozzles with the manifold.

To install:

13. Position a new gasket on the cylinder head.
14. Install the intake manifold with the fuel delivery pipe and injection nozzles.
15. Install the bolts and nuts. Tighten them evenly to 14 ft. lbs. (19 Nm).
16. Install the EGR valve. Clean the bolt threads, removing any carbon or oil deposits. For the bolt closest to the front of the engine, apply sealant to the 2 or 3 threads closest to the end of the bolt. Install the bolts and nuts.
17. Install the air intake chamber with the throttle body. Use a new gasket. Tighten the bolts to 14 ft. lbs. (19 Nm).
18. Install the EGR wires and hoses.
19. Connect the air valve hose.

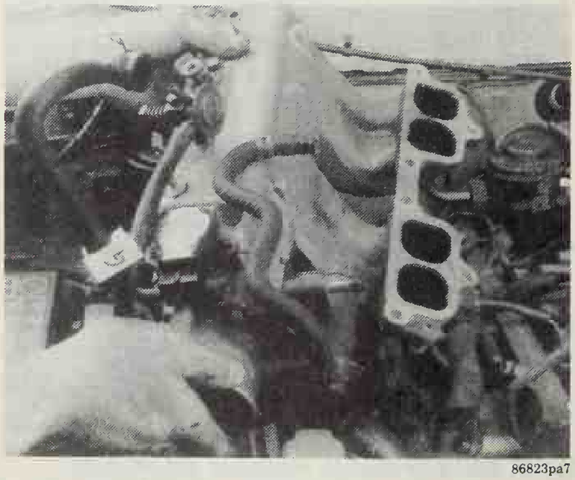


Fig. 82 With the air intake chamber removed, the manifold can now be accessed for removal

20. Connect the fuel hose to the fuel delivery pipe.
21. Install the actuator cable, accelerator cable, and throttle control cable (auto. trans.).
22. Connect the wires to the cold start injector, fuel injectors, throttle position sensor. Connect the water hoses to the throttle body.
23. Connect the vacuum lines.
24. Install the air intake tubing.
25. Refill the cooling system with coolant.
26. Connect the negative battery cable.
27. Start the engine and check for leaks. Top off any fluid levels.

3VZ-E Engines

See Figures 83 and 84

1. Disconnect the negative battery cable.

WARNING

The air bag system is equipped with a back-up power source. To avoid possible air bag deployment, do not start working on the vehicle until 90 seconds has elapsed from the time the ignition switch is turned OFF and the negative battery terminal is disconnected.

2. Drain the cooling system.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Disconnect the air intake hose from both the air cleaner assembly on one end and the air intake chamber on the other.
4. Tag and disconnect all vacuum lines attached to the intake chamber and manifold.
5. Disconnect the throttle position sensor connector at the air chamber. Disconnect the PCV hose at the union.
6. Disconnect the water bypass hose at the manifold. Remove the bypass hose at the water bypass pipe.
7. Disconnect the cold start injector and the vacuum hose at the fuel filter.
8. Remove the union bolt and two gaskets and then remove the cold start injector tube.
9. Disconnect the EGR gas temperature sensor (Calif.) and the EGR vacuum hoses from the air pipe and the vacuum modulator.
10. Remove the EGR valve.
11. Disconnect the air hose at the reed valve.
12. Remove the air intake chamber and then remove the engine wire harness (held with 2 bolts).
13. Remove the four union bolts and then remove fuel pipes.
14. Remove the timing belt covers.
15. Remove the fuel delivery pipes with their injectors.

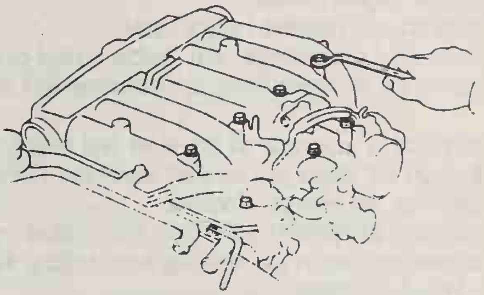


Fig. 83 There are 7 bolts securing the air intake chamber on the 3VZ-E engine

16. Remove the water bypass outlet. Progressively loosen the retaining bolts and remove the intake manifold.

To install:

17. Install the intake manifold with new gaskets and tighten the mounting bolts to 29 ft. lbs. (39 Nm).
18. Install the water bypass outlet and tighten the two bolts to 13 ft. lbs. (18 Nm).
19. Install the fuel delivery pipes and injectors.
20. Install the timing belt covers and tighten the bolts to 74 inch lbs. (8.3 Nm).
21. Install the fuel pipes and tighten the union bolts to 22 ft. lbs. (29 Nm).
22. Install the engine wire harness.
23. Install the air intake chamber and tighten the nuts and bolts to 13 ft. lbs. (18 Nm).
24. Install the EGR valve and connect all hoses and lines.
25. Install the air cleaner duct.
26. Refill the engine with coolant.
27. Connect the negative battery cable.
28. Start the engine and check for leaks. Top off any fluid levels.

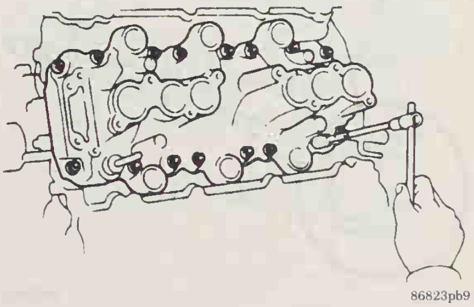


Fig. 84 The intake manifold bolts can be accessed after the intake chamber is removed

3F-E Engine

➧ See Figures 85 and 86

1. Drain the engine coolant.
2. Disconnect the negative battery cable.
3. Disconnect the accelerator and throttle control cable.
4. Remove the air intake hose, air flow meter and air cleaner.
5. Disconnect or reposition all the wires and hoses running near or through the intake and exhaust manifolds. Remove the heat shields from the exhaust manifold.
6. Disconnect the exhaust pipes from the exhaust manifold.
7. Progressively loosen the retaining bolts holding the intake and exhaust manifold
8. Remove the intake and exhaust manifolds. They are individual pieces. Remove the combination gasket.

To install:

9. Place a new gasket so that the FRONT mark is towards the front side, facing outward.
10. Install the intake and exhaust manifolds with the ten bolts, four plate washers and nuts. Tighten the nuts and bolts correctly. Use the illustration for correct placement:
    - (A) 17mm bolts — 51 ft. lbs. (69 Nm)
    - (B) 14 mm bolts — 37 ft. lbs. (50 Nm)
    - (C) nuts — 41 ft. lbs. (56 Nm)
11. Install new gaskets and secure the exhaust pipes to the manifold.
12. Install the heat shields and manifold support.
13. Connect the wires and hoses removed in Step 5.
14. Install the air cleaner, air flow meter and air intake duct.
15. Connect the accelerator and throttle control cables.
16. Fill the system with coolant.
17. Connect the negative battery cable.
18. Start the engine and check for leaks. Top off any fluids.

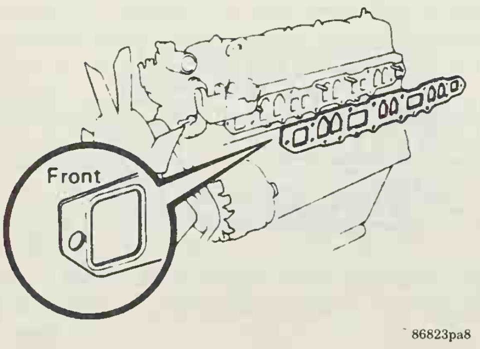


Fig. 85 Position the gasket on the engine as shown

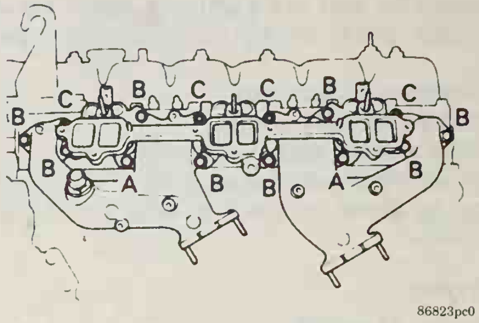


Fig. 86 Be sure to install the fasteners in the correct locations

5VZ-FE Engine

➧ See Figures 87 and 88

1. Relieve the fuel pressure.

⁂CAUTION

Fuel injected engine systems remain under pressure after the engine has been turned OFF. Properly relieve the fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

2. Disconnect the negative battery cable.

⁂WARNING

The air bag system is equipped with a back-up power source. To avoid possible air bag deployment, do not start working on the vehicle until 90 seconds has elapsed from the time the ignition switch is turned OFF and the negative battery terminal is disconnected.

3. Drain the engine coolant.
4. Remove the air cleaner hose.
5. Disconnect the following cables:
    - On cruise control vehicles, the actuator cable with bracket
    - Accelerator cable
    - On automatics, the throttle cable
6. If equipped with an EGR valve, remove the EGR pipe and gaskets.
7. Remove the intake chamber stay as follows:
    a. Remove the oil filler tube and the throttle cable clamp.
    b. Remove the intake chamber stay.
8. Remove the following connectors:
    - Vacuum Switching Valve (VSV) connector for the fuel pressure control
    - Throttle positioning sensor
    - Idle Air Control (IAC) valve
    - Disconnect the EGR gas temperature connector
    - Disconnect the VSV connector for the EGR valve

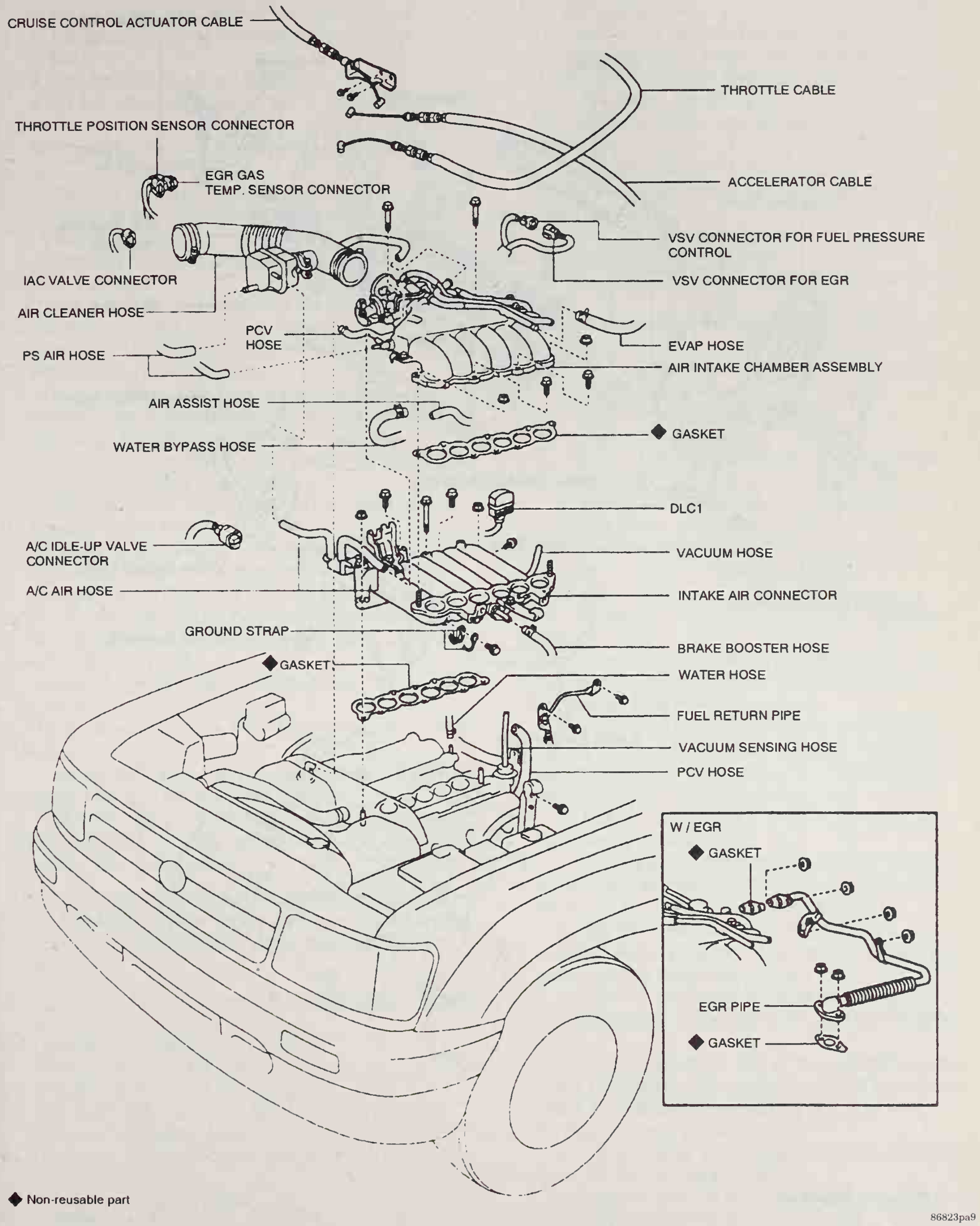
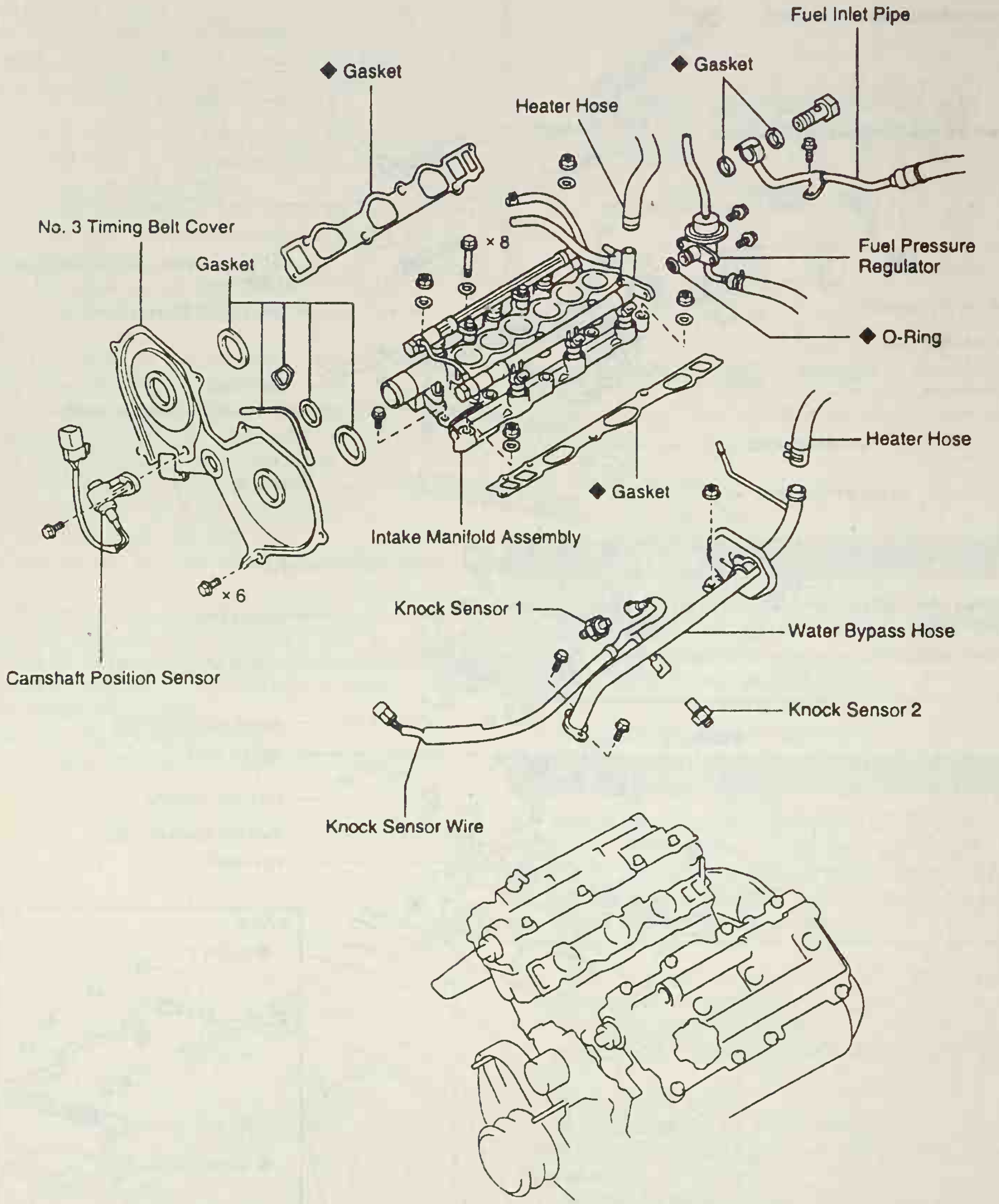

CRUISE CONTROL ACTUATOR CABLE
THROTTLE CABLE
THROTTLE POSITION SENSOR CONNECTOR
EGR GAS TEMP. SENSOR CONNECTOR
ACCELERATOR CABLE
VSV CONNECTOR FOR FUEL PRESSURE CONTROL
VSV CONNECTOR FOR EGR
IAC VALVE CONNECTOR
AIR CLEANER HOSE
PCV HOSE
PS AIR HOSE
EVAP HOSE
AIR INTAKE CHAMBER ASSEMBLY
AIR ASSIST HOSE
◆ GASKET
WATER BYPASS HOSE
DLC1
A/C IDLE-UP VALVE CONNECTOR
VACUUM HOSE
A/C AIR HOSE
INTAKE AIR CONNECTOR
GROUND STRAP
BRAKE BOOSTER HOSE
◆ GASKET
WATER HOSE
FUEL RETURN PIPE
VACUUM SENSING HOSE
PCV HOSE
W / EGR
◆ GASKET
EGR PIPE
◆ GASKET
◆ Non-reusable part
86823pa9

Fig. 87 Exploded view of the air intake chamber assembly


Fuel Inlet Pipe
◆ Gasket
◆ Gasket
Heater Hose
No. 3 Timing Belt Cover
Gasket
× 8
Fuel Pressure Regulator
◆ O-Ring
Heater Hose
◆ Gasket
Intake Manifold Assembly
× 6
Knock Sensor 1
Water Bypass Hose
Camshaft Position Sensor
Knock Sensor 2
Knock Sensor Wire

◆ Non-reusable part

86823pb1

Fig. 88 Exploded view of the intake manifold assembly

9. Disconnect the following hoses:
- PCV
- Water bypass
- Air assist from the intake air connector
- Two vacuum sensing hoses from the VSV
- EVAP
- Air hose from the power steering
- On A/C vehicles, disconnect the air hose from the idle up valve

10. Remove the bolts, nuts then the intake chamber assembly.

11. Remove the air intake connector as follows:

a. Disconnect the engine wire from the intake connector.

b. Disconnect the two fuel return hoses.

c. Disconnect the brake booster vacuum hose from the intake air connector.

d. Remove the bolt and disconnect the ground strap from the intake air connector.

e. Disconnect the Data Link Connector No. 1 (DLC1) from the bracket of the intake connector.

f. On A/C vehicles, disconnect the idle up valve.

g. Remove the air intake connector from the engine.

12. Disconnect the spark plug wires.

13. Remove the engine splash shield from under the engine.

14. Disconnect the upper radiator hose.

15. Remove the power steering, A/C and alternator belts.

16. Remove the fan shroud.

17. Remove the fan shroud with the coupling and pulleys.

18. Disconnect the power steering pump from the engine, then set aside. Do not disconnect the lines from the pump.

19. On A/C vehicles, remove the compressor. Do not disconnect the lines from the compressor, then set aside. Unbolt the bracket from the compressor.

20. Remove the power steering adjusting strut. Then remove the fan bracket.

21. Set the No. 1 cylinder at TDC of the compression stroke as follows:

a. Turn the crankshaft pulley and align it's groove with the timing mark **0** of the timing belt cover.

b. Check the timing marks of the camshaft timing pulleys and the timing belt cover are aligned. If not, turn the crankshaft pulley one revolution (360°).

➡If reusing the timing belt, make sure that you can still read the installation marks. If not, place new marks on the belt to match the timing marks of the camshaft timing pulleys.

22. Remove the timing belt tensioner by alternately loosening the bolts.

23. Remove the camshaft timing pulleys.

24. Remove the crankshaft pulley.

25. Remove the timing belt idler pulley.

26. Disconnect and remove the fuel pressure regulator.

27. Disconnect the heater hose.

28. Disconnect the engine wiring from the intake manifold:
- Oil pressure sensor
- Crankshaft position sensor
- Injectors
- ECT sender gauge
- ECT sensor
- Knock sensor
- Camshaft position sensor
- Disconnect the engine wire clamps
- Remove the bolts, then disconnect the engine wire from the cylinder head

29. Remove the camshaft position sensor.

30. Unbolt the No. 3 (rear) timing belt cover.

31. Disconnect the fuel inlet hose, then remove the bo,to securing the intake manifold stay.

32. Unbolt the intake manifold assembly.

To install:

33. Clean all mating surfaces.

34. Install new gaskets on the intake and tighten down to 13 ft. lbs. (18 Nm).

35. Install the intake stay, tighten to 14 ft. lbs. (18 Nm).

36. Connect the fuel inlet hose.

37. Attach the timing cover, tighten the bolts to 80 inch lbs. (9 Nm).

38. Install the camshaft position sensor, tighten to 71 inch lbs. (8 Nm).

39. Attach all the engine wiring to the intake manifold.

40. Install the heater hose.

41. Attach the fuel pressure regulator.

42. Install the timing belt idler.

43. Attach the left camshaft timing pulley as follows:

a. Install the knock pin to the camshaft.

b. Align the knock pin hose of the camshaft with the knock pin groove of the timing pulley.

c. Slide the timing pulley on the camshaft with the flange side facing outward. Tighten the pulley bolt to 81 ft. lbs. (110 Nm).

44. Set the No. 1 cylinder to TDC of the compression stroke.

45. Connect the timing belt to the left camshaft timing pulley. Check that the installation mark of the timing belt is aligned with the end of the timing belt cover.

a. Using a SST 09960-01000 or equivalent, slightly turn the left camshaft timing pulley clockwise. Align the installation mark with the timing belt on the camshaft pulley. Hang the timing belt on the left camshaft pulley.

b. Align the timing marks of the left camshaft pulley and the timing belt cover.

c. Check that the timing belt has tension between the crankshaft timing pulley and the left camshaft pulley.

46. Install the right camshaft pulley and belt:

a. Align the installation mark with the timing belt on the camshaft pulley. Hang the timing belt on the right camshaft pulley with the flange facing inward.

b. Slide the right camshaft pulley on the camshaft. Align the timing marks on the right pulley and the timing belt cover.

c. Align the knock pin hole of the camshaft with the knock pin groove of the pulley, then install the knock pin. Install the bolt and tighten to 81 ft. lbs. (110 Nm).

47. Set the timing belt tensioner:

a. Using a press, slowly press in the pushrod using 220-2205 lbs. (981-9807 N) of force.

b. Align the holes of the pushrod and housing, pass a 1.5mm hexagon wrench through the holes to keep the setting position of the pushrod.

c. Release the press and install the dust boot to the tensioner.

48. Install the timing belt tensioner and alternately tighten the bolts to 20 ft. lbs. (28 Nm). Using pliers, remove the 1.5 mm hexagon wrench from the belt tensioner.
49. Check the valve timing.
50. Install the fan bracket.
51. Install the power steering adjusting strut.
52. Install the timing belt cover. Tighten the bolts to 80 inch lbs. (9 Nm).
53. Connect the clamps for the spark plug wires to the timing belt cover.
54. Connect the camshaft position sensor to the timing belt cover.
55. On vehicles with A/C, install the compressor bracket and compressor.
56. Attach the fan with coupling and pulleys, tighten the nuts to 48 inch lbs. (5 Nm).
57. Install the fan shroud.
58. Install the alternator belt and cooling fan, tighten the fan nuts to 4 ft. lbs. (5 Nm).
59. Install the A/C belt.
60. Attach the power steering pump, pulley and drive belt.
61. Connect the upper radiator hose.
62. Fill the radiator with a coolant/water mixture.
63. Connect the spark plug wires to the plugs.
64. Install the intake air connector:
    a. Install the intake manifold, then tighten the bolts and nuts to 14 ft. lbs. (18 Nm).
    b. Connect the DLC1 to the bracket on the intake manifold.
    c. Connect the ground strap to the manifold.
    d. Attach the brake booster vacuum hose to the intake air connector.
    e. Connect the two fuel return hoses.
    f. Attach the engine wire to the intake manifold.
    g. On A/C models, connect the idle up valve connector.
65. Install the air intake chamber assembly, tighten the bolts to 14 ft. lbs. (18 Nm).
66. Attach these hoses:
    - PCV
    - Water bypass
    - Air assist from the intake air connector
    - Two vacuum sensing hoses from the VSV
    - EVAP
    - Air hose from the power steering
    - On A/C vehicles, connect the air hose to the idle up valve
67. Connect the following wiring:
    - Vacuum Switching Valve (VSV) connector for the fuel pressure control
    - Throttle positioning sensor
    - Idle Air Control (IAC) Valve
    - Connect the EGR gas temperature connector
    - Connect the VSV connector for the EGR valve
68. Install the intake chamber stay:
    a. Install the intake chamber stay bolts, tighten to 30 ft. lbs. (40 Nm).
    b. Install a new O-ring to the oil filler tube.
    c. Push the oil filler tube end into the tube hole in the pan.
    d. Attach the filler tube and the throttle cable clamp.
69. Install new gaskets on the EGR pipe. Tighten the clamp nuts to 71 inch lbs. (8 Nm), and the EGR pipe nuts to 14 ft. lbs. (18 Nm).
70. Connect the cables removed earlier.
71. Install the air cleaner hose.
72. Fill the radiator with a mixture of coolant and water.
73. Start the engine and check for leaks. Top off any fluids.

1FZ-FE Engine

➧ **See Figure 89**

1. Relieve the fuel pressure.

⁑⁑CAUTION

Fuel injected engine systems remain under pressure after the engine has been turned OFF. Properly receive the fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

2. Disconnect the negative battery cable.

⁑⁑WARNING

The air bag system is equipped with a back-up power source. To avoid possible air bag deployment, do not start working on the vehicle until 90 seconds has elapsed from the time the ignition switch is turned OFF and the negative battery terminal is disconnected.

3. Drain the engine coolant.
4. Remove the air cleaner hose and cap.
5. Disconnect the following cables:
    - On cruise control vehicles, the actuator cable from the throttle body
    - Accelerator cable
    - Throttle cable (auto transmission)
6. Disconnect the engine ground strap from the engine hanger and the ground strap from the air intake chamber.
7. Detach the connection on the intake manifold from the left fender apron.
8. Disconnect the brake booster and EVAP hoses.
9. Separate the fuel inlet and return lines from the fuel rail.
10. Remove the intake manifold stay.
11. Disconnect the following electrical connections:
    - Engine Coolant Temperature (ECT) sender gauge
    - ECT cut switch
    - ECT sensor
    - Knock sensor
    - Crankshaft position sensor
12. Remove the bolt that secures the engine harness to the cylinder block.
13. Disconnect the PCV hose from the PCV valve.
14. Remove the bolt that secures the engine harness to the intake manifold.
15. Disconnect the following:
    - Engine wire clamps
    - EGR temperature sensor connector
    - The fuel injector connections
    - The connector for the emission control valve set
16. Remove the water bypass pipe.

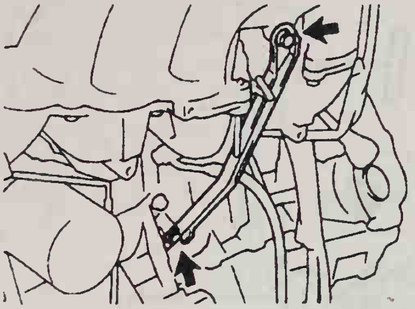


Fig. 89 Remove the two bolts securing the intake manifold stay

17. Remove the air intake chamber and the intake manifold assembly.
    a. Disconnect the vacuum hoses at the Thermal Vacuum (TVV) Valve.
    b. Remove the bolts securing the intake manifold and gasket.

To install:

18. Install the air intake chamber and intake manifold assembly:
    a. Place a new gasket so that the rear mark is toward the rear side.
    b. Tighten the intake manifold bolts to 15 ft. lbs. (21 Nm).
    c. Connect the vacuum hoses to the TVV.
19. Install the water bypass pipe.
20. Connect the following:
    - Engine wire clamps
    - EGR gas temperature sensor connection
    - Fuel injector connections
    - The connector for the emission control valve set
21. Install the bolt that secures the engine wire harness to the intake manifold.
22. Connect the PCV hose to the PCV valve.
23. Install the bolt that secures the engine wire harness to the cylinder block.
24. Connect the following wires:
    - Engine Coolant Temperature (ECT) sender gauge
    - ECT cut switch
    - ECT sensor
    - Knock sensor
    - Crankshaft position sensor
25. Attach the intake manifold stay and tighten the bolts to 26 ft. lbs. (36 Nm).
26. Install the radiator inlet hose, the water bypass hose, and the alternator.
27. Install the heater hose to the cylinder head, then connect the pipe to the intake manifold. Tighten the bolts to 15 ft. lbs. (21 Nm).
28. Connect the fuel inlet and return hoses to the fuel rail.
29. Connect the brake booster and EVAP hoses.
30. Attach the connector on the intake manifold to the left fender apron.
31. Connect the ground straps to the engine hanger and the air intake chamber.
32. Attach the throttle cable to the throttle body.
33. Attach the accelerator cable to the throttle body.
34. Install the air cleaner hose and cap.
35. Connect the negative battery cable.
36. Refill the coolant and water mixture to the radiator.
37. Start the engine and check for leaks. Top off any fluids.

Exhaust Manifold

REMOVAL & INSTALLATION

⁂CAUTION

When working on or around a manifold, make ceratin all surfaces are cool to the touch before beginning to work.

22R, 22R-E, and 3VZ-E Engines

➧ See Figures 90, 91 and 92

1. Remove the three exhaust pipe flange bolts and disconnect the exhaust pipe from the manifold.
2. Tag and disconnect the spark plug leads. Position the spark plug wires out of the way. It is best to tie them so they don't get in your way.
3. Remove the air cleaner tube from the heat stove on carbureted engines, and remove the outer part of the heat stove.
4. Use a 14 mm wrench to remove the manifold retaining nuts.
5. Remove the manifold(s), complete with air injection tubes and the inner portion of the heat stove.
6. For 22R engines, separate the inner portion of the heat stove from the manifold.

To install:

7. Always use a new gasket. Install any disassembled parts onto the manifold and place it in position.
8. Install the nuts and bolts, tightening them to 30 ft. lbs. (40 Nm).
9. Install the air cleaner and spark plug leads. Connect the air intake tube(s).
10. Connect the exhaust pipe to the manifold, tightening the bolts to 30 ft. lbs. (40 Nm)

5VZ-FE Engine

➧ See Figures 93 and 94

LEFT SIDE

1. Disconnect the exhaust crossover pipe from the exhaust manifold.
2. Remove the EGR pipe from the manifold.
3. Remove the heat insulator from the manifold.
4. Remove the manifold.

To install:

5. Install the exhaust manifold to the engine with a new gasket. Tighten the nuts to 30 ft. lbs. (40 Nm).
6. Install the heat insulator, tighten the nuts down to 71 inch lbs. (8 Nm).

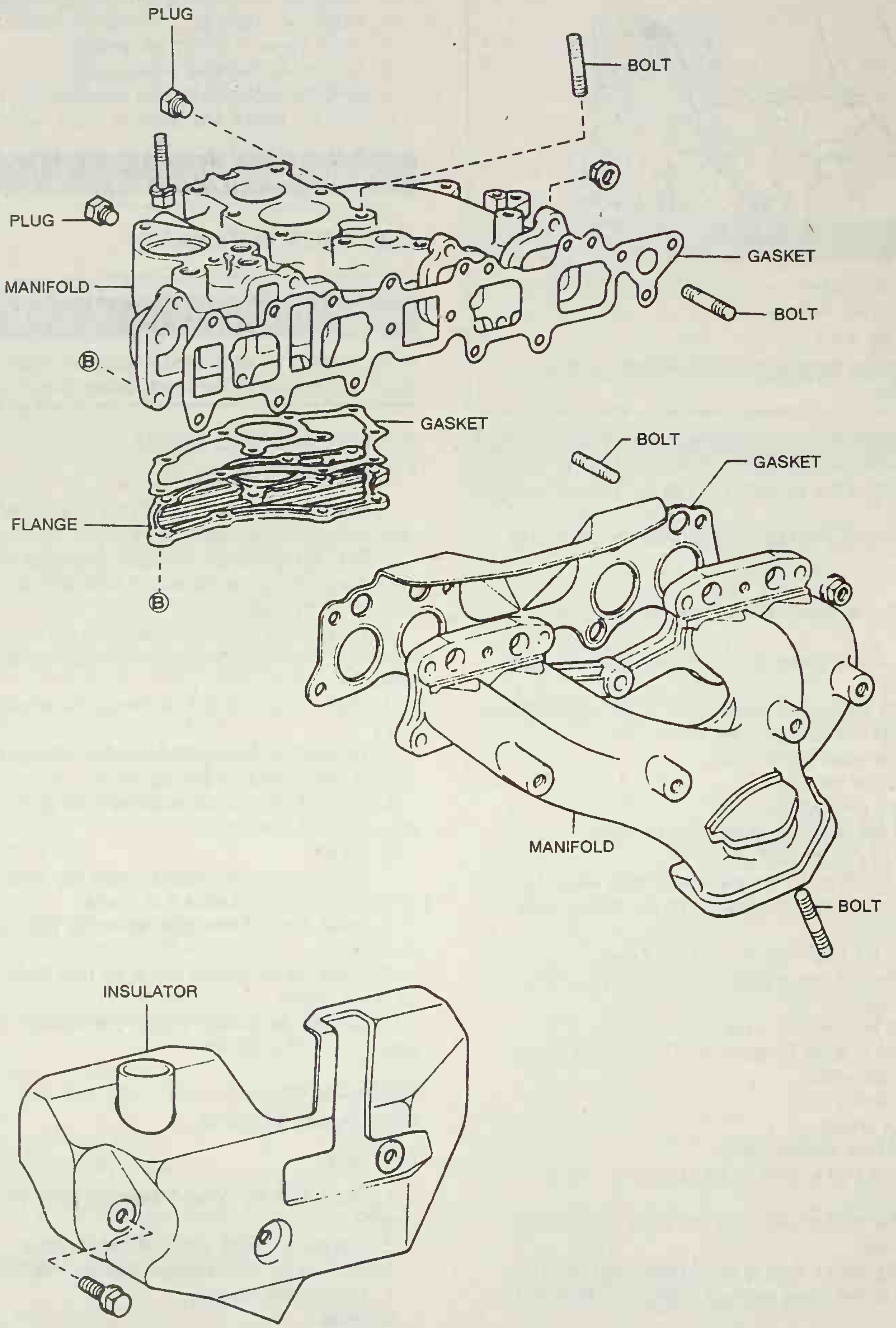
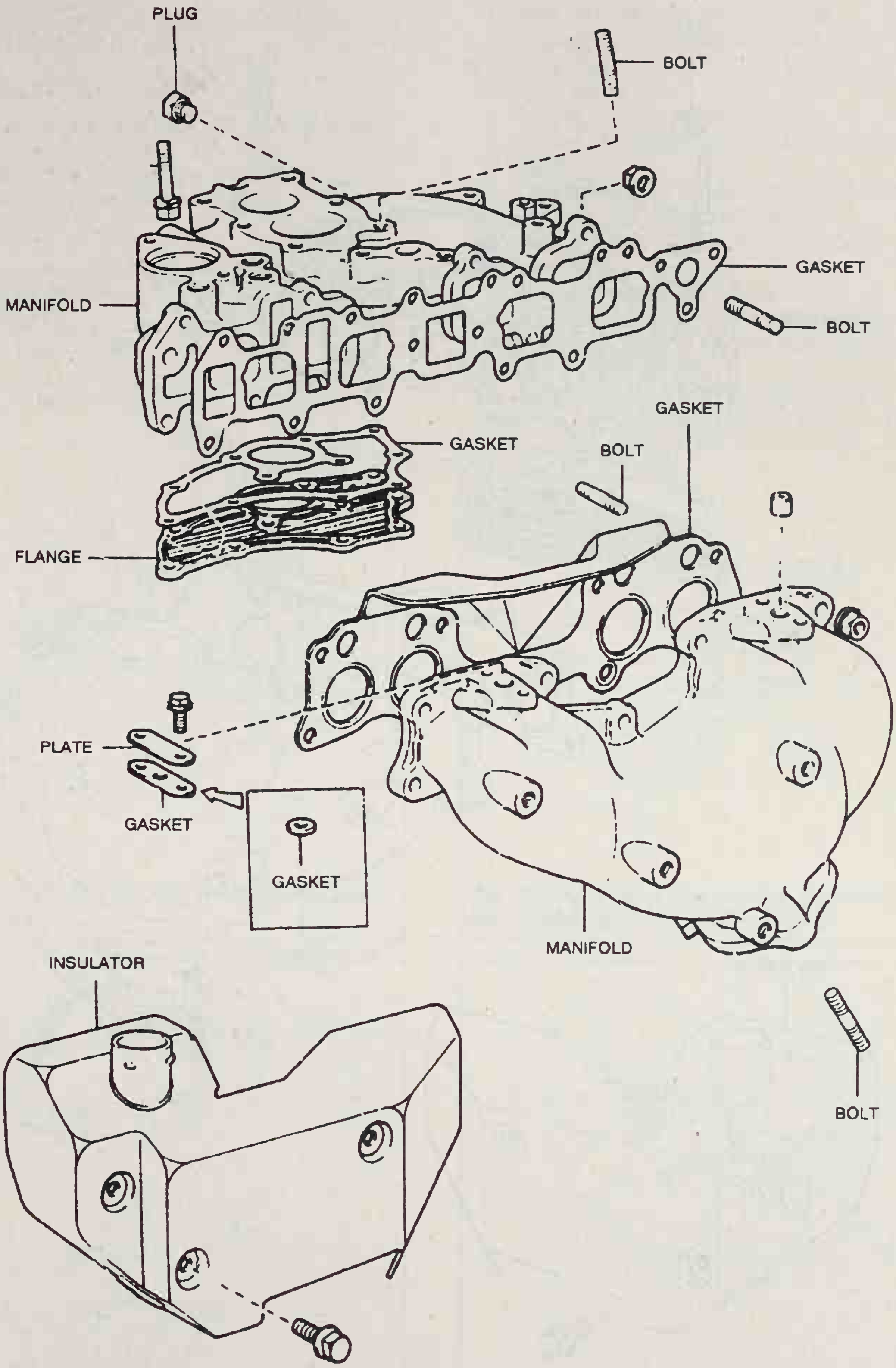

PLUG
BOLT
PLUG
GASKET
MANIFOLD
BOLT
Ⓑ
GASKET
BOLT
GASKET
FLANGE
Ⓑ
MANIFOLD
BOLT
INSULATOR
86823pc2

Fig. 90 Exploded view of the exhaust manifold assembly found on 22R engines with Federal emissions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GASKET
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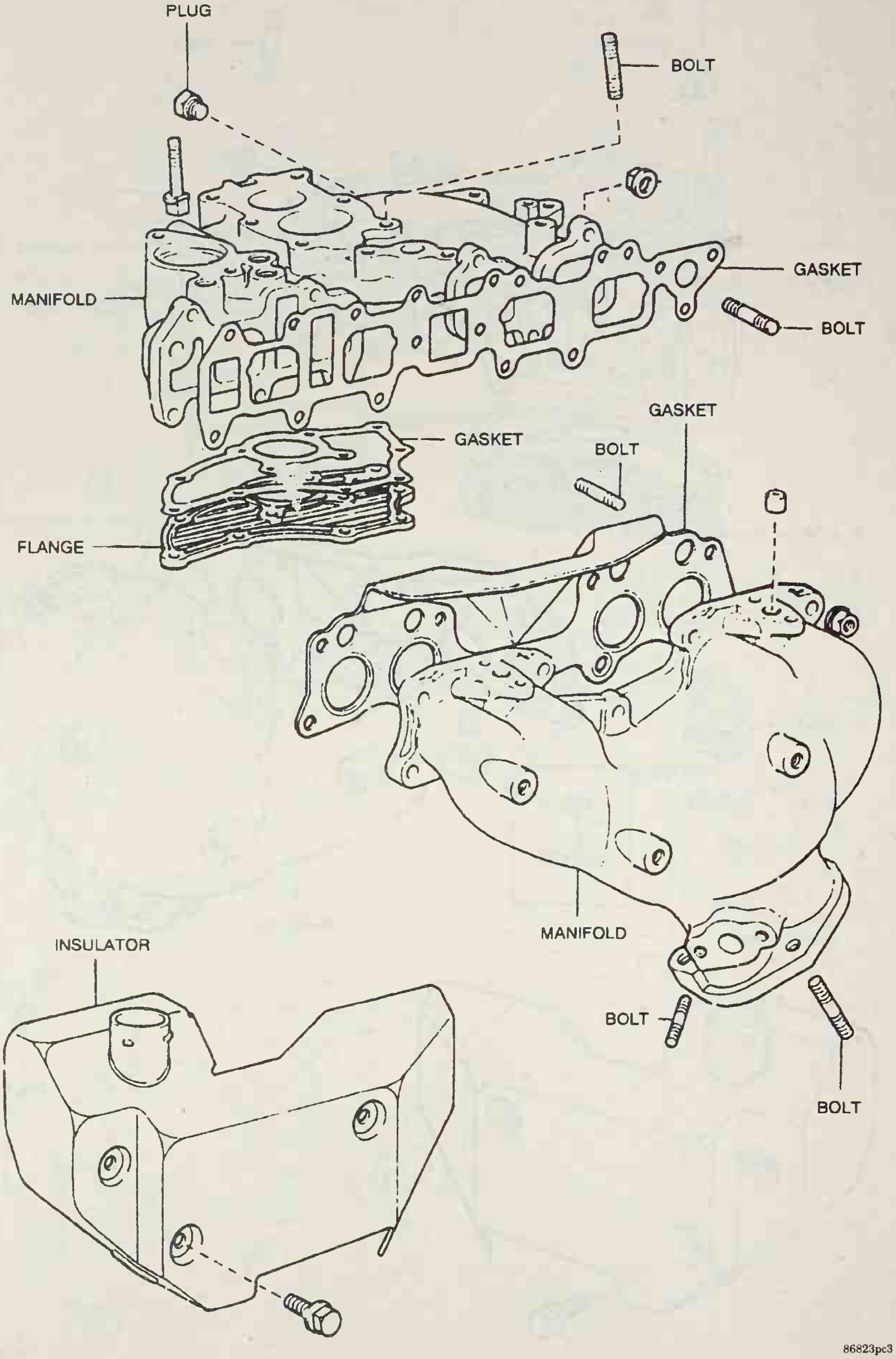
FLANGE
PLATE
GASKET
GASKET
MANIFOLD
INSULATOR
BOLT
86823pc1

Fig. 91 Exhaust manifold found on 22R engines with Canadian emissions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GASKET
GASKET
BOLT
FLANGE
MANIFOLD
INSULATOR
BOLT
BOLT
86823pc3

Fig. 92 Exploded view of the 22R California emission exhaust manifold assembly

7. Connect the EGR pipe to the manifold. Tighten the nuts to 14 ft. lbs. (18 Nm). Tighten the clamp nuts to 71 inch lbs. (8 Nm).
8. Attach the crossover pipe to the exhaust manifold, tighten the nuts to 33 ft. lbs. (45 Nm).

RIGHT SIDE

1. Disconnect the exhaust crossover pipe from the exhaust manifold.
2. Remove the exhaust manifold heat insulator.
3. Unfasten the six nuts securing the manifold from the engine.

To install:

4. Install the exhaust manifold with the new gasket, tighten the six nuts to 30 ft. lbs. (40 Nm).
5. Attach the heat insulator, tighten the nuts to 71 inch lbs. (8 Nm).
6. Connect the crossover pipe with a new gasket, to the exhaust manifold. Tighten the nuts to 33 ft. lbs. (45 Nm).

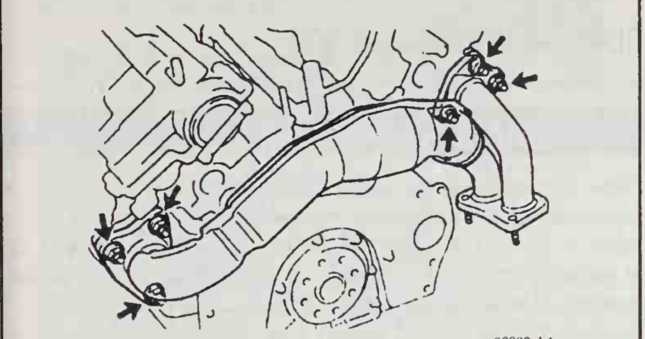

Fig. 93 Remove the bolts securing the crossover pipe to the manifold(s)

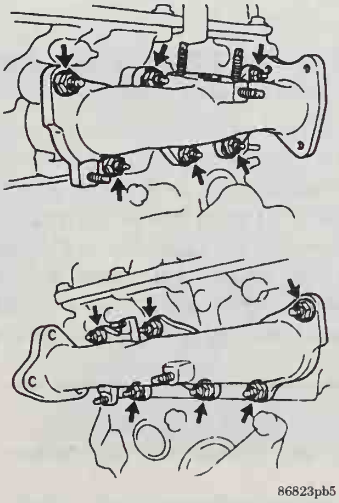

Fig. 94 Exhaust manifold retaining nut locations

2RZ-FE and 3RZ-FE Engines

➧ See Figures 95 and 96

1. Raise and safely support the vehicle.
2. Disconnect the front exhaust pipe from the manifold and mounting bracket.
3. Lower the vehicle.
4. Remove the heat insulator.
5. Remove the exhaust manifold and gasket.

To install:

6. Install the exhaust manifold and gasket to the engine, tighten the nuts to 36 ft. lbs. (49 Nm).
7. Attach the heat insulator, tighten the bolts and nuts to 48 inch lbs. (5 Nm).
8. Raise and support the vehicle.
9. Install the front exhaust pipe to the manifold with new gaskets. Apply a gasket to the front pipe, install the nuts and tighten to 46 ft. lbs. (62 Nm).
10. Attach the support bracket, tighten to 29 ft. lbs. (39 Nm).
11. Attach the clamp and tighten to 14 ft. lbs. (19 Nm).

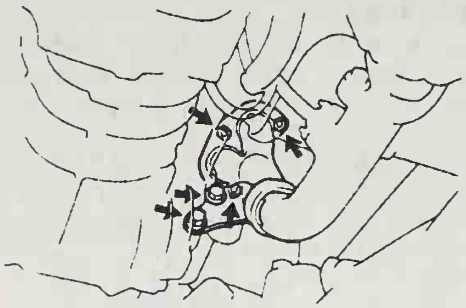

Fig. 95 The exhaust pipe must be disconnected from the manifold and its mounting bracket

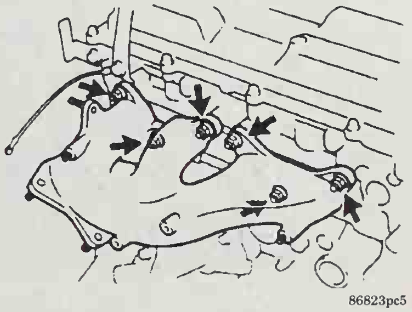

Fig. 96 Remove the nuts indicated to remove the exhaust manifold

12. Lower the vehicle.
13. Start the engine and check for exhaust leaks.

1FZ-FE Engine

➧ See Figures 97 and 98

1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle.
3. Working from underneath the vehicle, disconnect the oxygen sensor wire.
4. Remove the nuts and bolts holding the front header pipe to the catalytic converter.
5. Loosen the pipe clamp.
6. Remove the pipe bracket.
7. Unbolt the front header pipe and remove the gasket.
8. Lower the vehicle, remove the exhaust manifold heat shield insulators.
9. Remove the nuts from the exhaust manifolds, then the gaskets.

To install:

10. Install the exhaust manifolds to the engine with new gaskets. Uniformly tighten the nuts in several passes. Tighten the nuts to 29 ft. lbs. (39 Nm).
11. Install the exhaust manifold heat insulators, tighten down to 14 ft. lbs. (19 Nm).
12. Attach the header pipe to the exhaust manifold using new gaskets, tighten the nuts to 46 ft. lbs. (63 Nm).
13. Install the support bracket, then tighten to 17 ft. lbs. (24 Nm).
14. Attach the clamp, tighten to 14 ft. lbs. (19 Nm).
15. Connect the header pipe to the catalyst using a new gasket to prevent leaks. Tighten to 34 ft. lbs. (46 Nm).
16. Attach the oxygen sensor wire.
17. Connect the negative battery cable.
18. Start the engine and check for exhaust leaks.

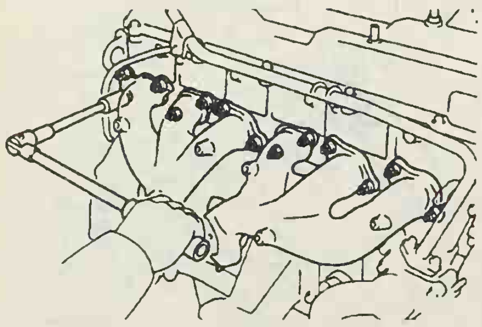

Fig. 97 An extension can be useful for reaching the manifold retaining nuts

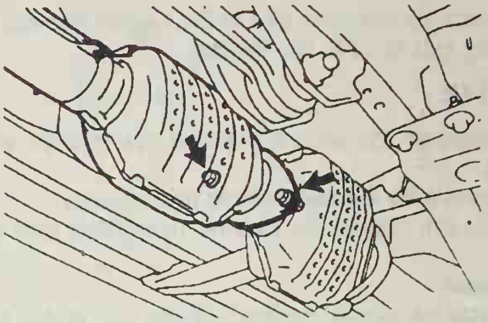

Fig. 98 Be sure to use new gaskets when attaching the front header pipe to the catalyst

Radiator

REMOVAL & INSTALLATION

✻✻CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

22R and 22R-E Engines

➧ See Figures 99, 100, 101, 102 and 103

1. Discharge the A/C system using an approved recovery/recycling machine. Refer to Section 1.
2. Drain the cooling system.

✻✻CAUTION

Never remove the pressure cap while the engine is running or personal injury from scalding hot coolant or steam may result. If possible, wait until the engine has cooled to remove the pressure cap. If this is not possible, wrap a thick cloth around the pressure cap and turn it slowly to the stop. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, still using the cloth, turn and remove the cap.

3. Remove the engine undercover.
4. Disconnect the reservoir hose and remove the reservoir tank.
5. Disconnect the radiator hoses.
6. Remove the fan shrouds.

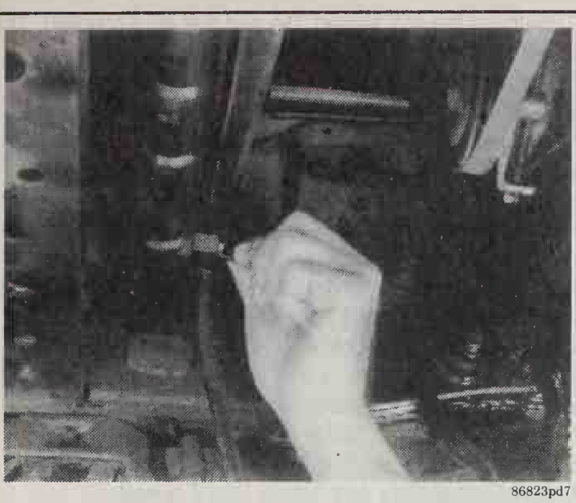
86823pd7

Fig. 99 Loosen the petcock and allow the coolant to drain into a suitable container

7. Disconnect the oil cooler lines (automatic transmission). Plug the lines immediately to prevent oil loss.
8. Remove the nuts and bolts holding the radiator. Carefully remove the radiator.

✱✱WARNING

Use care not to damage the radiator fins or the cooling fan.

To install:

9. If replacing with a used radiator or your old one, install a new O-ring onto the petcock.
10. Install the radiator and tighten the mounting bolts. Make certain all the rubber mounts and bushings are present and correctly placed.
11. Install oil cooler lines if they were removed.
12. Install the fan shrouds.
13. With new hose clamps, connect the radiator hoses.
14. Install the reservoir tank and connect the hoses.

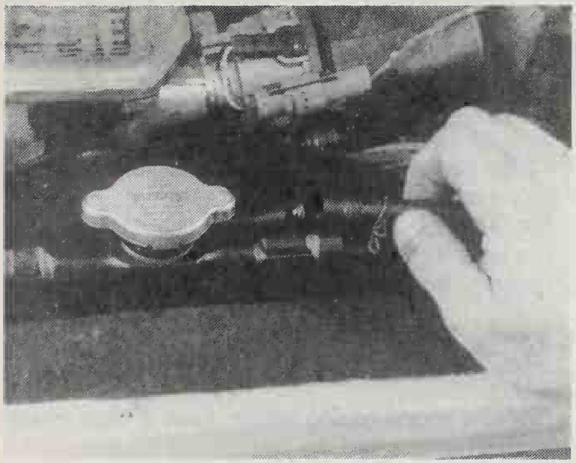
86823pd5

Fig. 100 Slide the clamp up the overflow hose, then disconnect the hose from the radiator neck

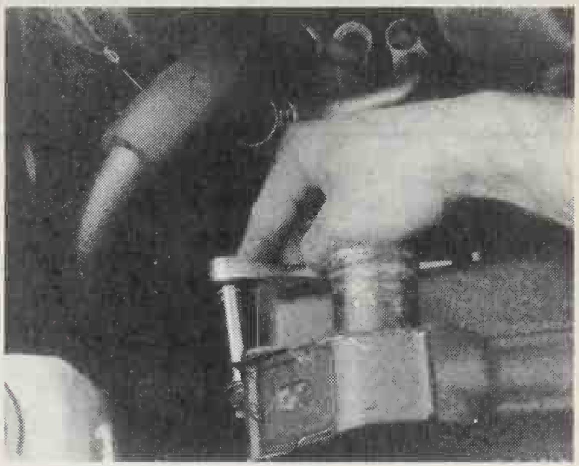
86823pd8

Fig. 102 It may be necessary to use a deep socket or an extension to access the retainers

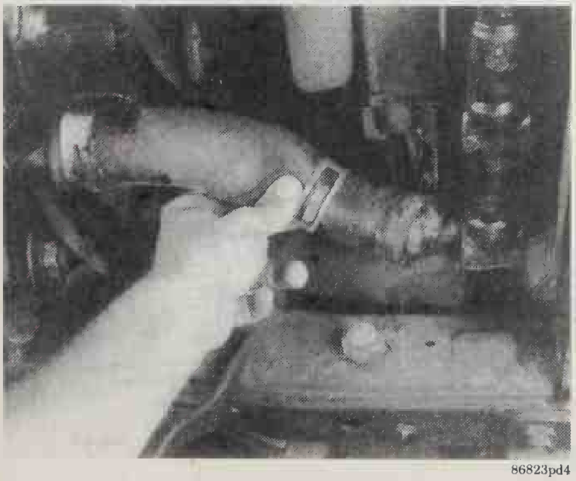
86823pd4

Fig. 101 Be careful when disconnecting the lower hose, as some coolant may be left in it

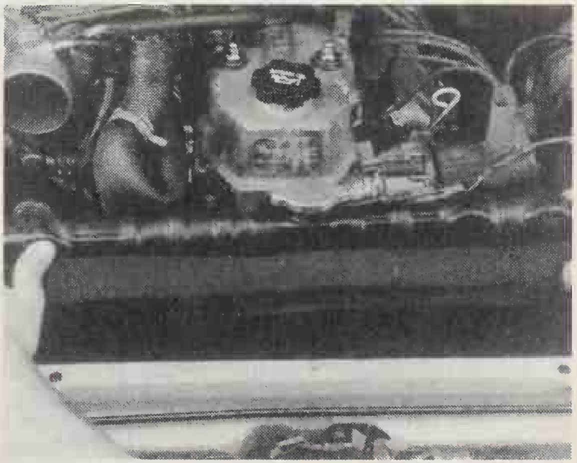
86823pd9

Fig. 103 Be careful not to damage the fins when lifting the radiator out

15. Fill the radiator with a water coolant mixture, start the engine and check for leaks.
16. Top off the coolant with the engine running.
17. On vehicles with automatic transmissions, check the level of the transmission fluid and adjust as needed. Some fluid may have been lost from the bottom of the radiator after removal.

3F-E Engine

▶ See Figures 104 and 105

1. Discharge the air conditioning system using a recovery/recycling machine. Refer to Section 1.
2. Drain the cooling system.

⁂CAUTION

Never remove the pressure cap while the engine is running or personal injury from scalding hot coolant or steam may result. If possible, wait until the engine has cooled to remove the pressure cap. If this is not possible, wrap a thick cloth around the pressure cap and turn it slowly to the stop. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, still using the cloth, turn and remove the cap.

3. On some models you will need to remove the front turn signal lamp assembly, radiator grille and headlamp doors.
4. Remove the hood lock brace, hood lock, grille center support and grille. Some models need the engine under cover removed.
5. On 1989-90 models you need to remove the battery and battery case.
6. Disconnect the A/C discharge hose and liquid tube.

➡Make sure you cap the open fittings immediately to keep moisture from entering the system.

7. Remove the condenser.
8. Disconnect the coolant reservoir hose and tank.
9. Remove the radiator hoses.
10. Remove the power steering and air conditioning belts.
11. Remove the fan shroud, fan and the fluid coupling. The alternator belt will need removal also.
12. Disconnect the A/T oil cooler hoses. You will need a suitable container to catch oil which will leak out on removal.
13. Remove the radiator mounting bolts, nuts and then the radiator.

To install:

14. If replacing with a used radiator or your old one, install a new O-ring onto the petcock.
15. Install the radiator and tighten the (A) mounting bolts to 13 ft. lbs. (18 Nm) and (B) bolts to 9 ft. lbs. (12 Nm). Make certain all the rubber mounts and bushings are present and correctly placed.
16. Install the fan, fluid coupling and the fan shroud.
17. Attach the A/T oil cooler hoses.
18. With new hose clamps, connect the radiator hoses.
19. Install the battery and battery tray if removed.
20. Reinstall the engine under cover.
21. Attach the coolant reservoir hose.
22. Install the air conditioning condenser.
23. Install the hood lock brace, hood lock, grille center support and grille.
24. Fill the radiator to the specified level and check for leaks.
25. Check the level of the transmission fluid and adjust as needed. Some fluid may have been lost during removal.
26. Fill the coolant/water mixture to the appropriate amount. Start the engine and top off.
27. Check the A/T fluid level, top off if needed.
28. Check for leaks.
29. Recharge the A/C system.

2RZ-FE and 3RZ-FE Engines

▶ See Figures 106, 107, 108 and 109

1. Drain the engine cooling system. Have a large enough suitable container to collect the fluid.
2. Remove the grille, filler and clearance lamps.
3. On the 3RZ-FE California models, disconnect the air pipe.
4. Disconnect the upper radiator hose.
5. Unsecure the radiator reservoir hose.

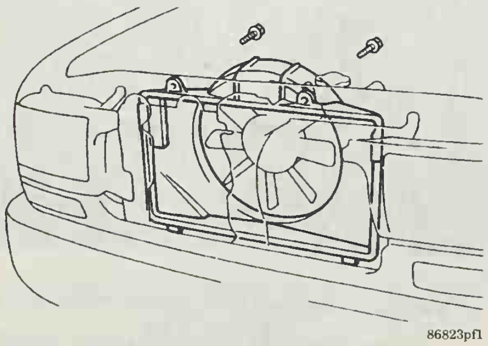

Fig. 104 The fan shroud is usually secured by two bolts

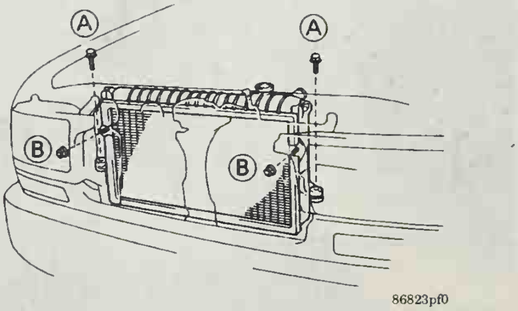

Fig. 105 (A) and (B) bolt locations

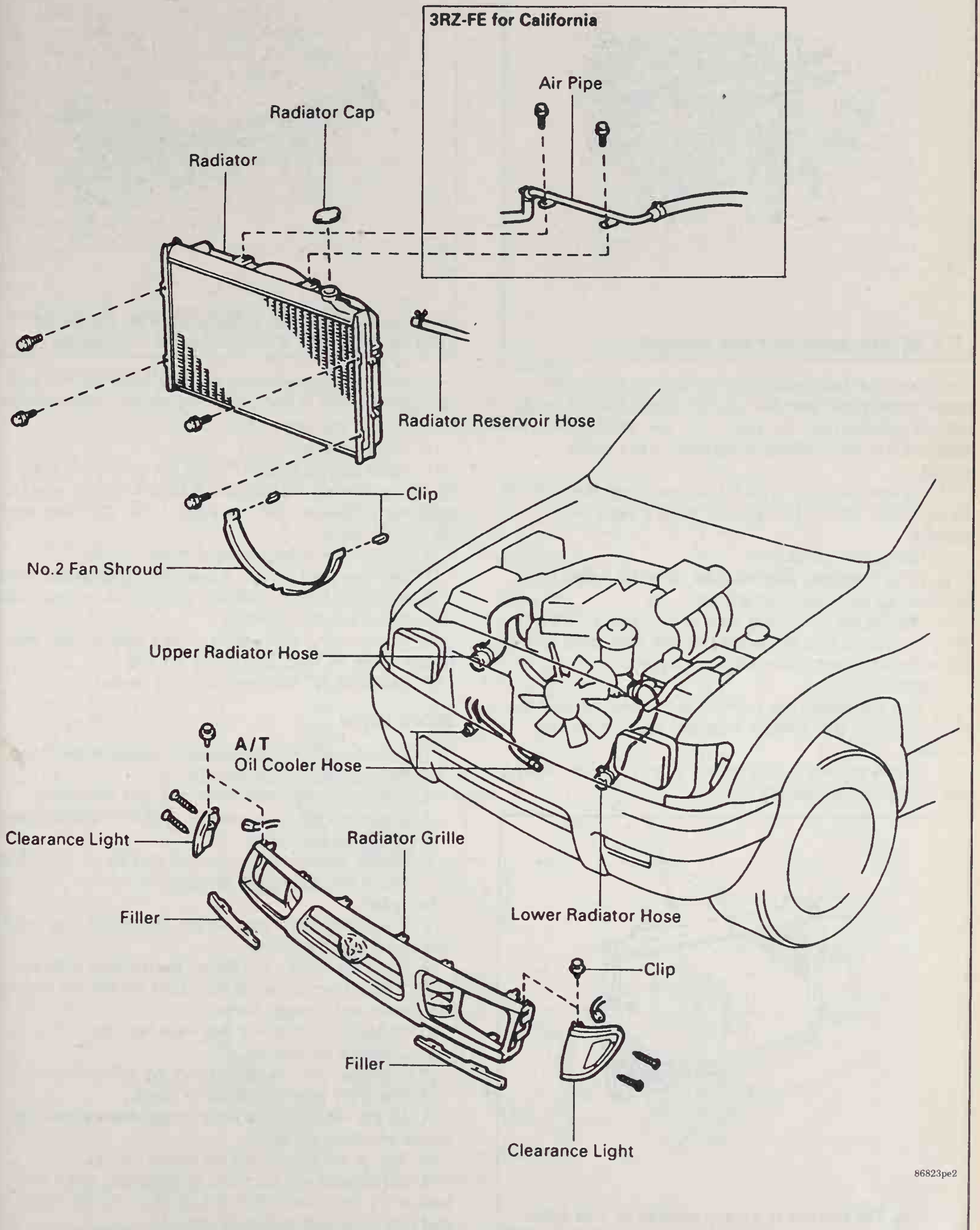
3RZ-FE for California
Air Pipe
Radiator Cap
Radiator
Radiator Reservoir Hose
Clip
No.2 Fan Shroud
Upper Radiator Hose
A/T
Oil Cooler Hose
Clearance Light
Radiator Grille
Filler
Lower Radiator Hose
Clip
Filler
Clearance Light
86823pe2

Fig. 106 Exploded view of a common radiator mounting found on 2VZ-FE and 3VZ-FE engines

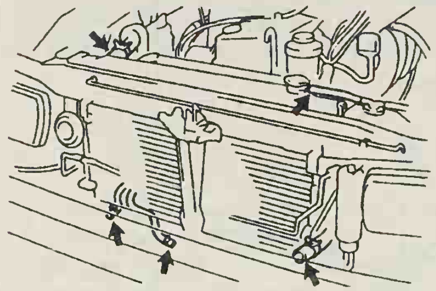

Fig. 107 Disconnect the hoses indicated

6. On some T100 models you will need to remove the power steering belt. With A/C vehicles, loosen the idler pulley nut and adjusting bolt, then remove the belt. Remove the alternator belt, fan with coupling, water pump pulley and fan shroud.
7. Remove the lower radiator hose, remember there will still be some fluid left in the lower hose. Have a catch pan available.
8. Remove the fan shroud.
9. On A/T vehicles, disconnect the oil cooler hoses. Plug the openings so oil does not drip out.
10. Remove the 4 mounting bolts for the radiator. When lifting the radiator from the vehicle, you will have some fluid still in the tank. Watch for spillage, it's slippery.

To install:

11. After the radiator has been removed there may be supports on the old unit. Remove them and install on the new radiator.
12. If replacing with a used radiator or your old one, install a new O-ring onto the petcock.

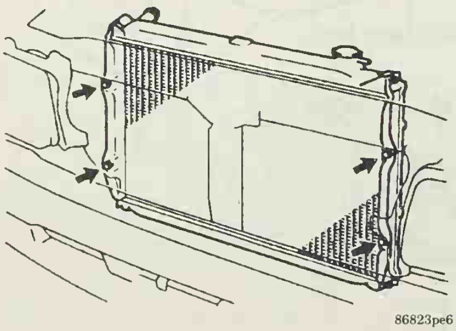

Fig. 108 The radiator is usually secured by four bolts

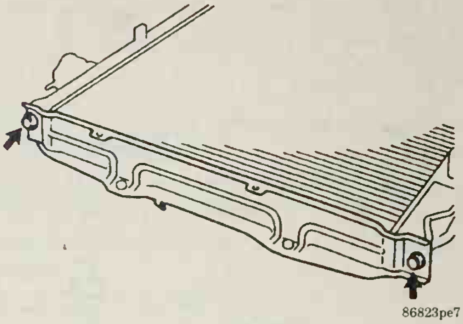

Fig. 109 If the radiator is being replaced, the support brackets should be transferred to the new radiator

13. With the supports on the new unit, install into the vehicle. Insert the tabs of the support through the radiator service holes. Tighten the radiator down to 9 ft. lbs. (12 Nm).
14. Connect the outlet hose.
15. If removed on the T100; install the water pump pulley, fan shroud, fan with coupling and drive belt vehicles with A/C, install the compressor belt then adjust. Install the power steering belt and adjust.
16. Connect the radiator reservoir hose.
17. With new hose clamps, connect the upper radiator hose.
18. Attach the radiator grille with the clips and screws. Install both clearance lamp assemblies.
19. Fill the engine with a water coolant mixture. Start the engine, check for leaks, and top off the fluid.
20. Check the A/T fluid level, top off if needed.

5VZ-FE Engine

1. Drain the engine cooling system, discard of the O-ring.
2. Remove the front bumper filler.
3. Take off the clearance lamps and grille assemblies.
4. Disconnect the upper, reserve and lower radiator hoses.
5. Unbolt the fan shroud.
6. On A/T vehicles, disconnect and plug the oil cooler lines.
7. Unbolt the radiator and lift out of the vehicle.

To install:

8. If replacing with a used radiator or your old one, install a new O-ring onto the petcock.
9. Install the radiator and tighten the mounting bolts to 9 ft. lbs. (12 Nm). Make certain all the rubber mounts and bushings are present and correctly placed.
10. Install oil cooler lines if they were removed.
11. Install the fan shrouds.
12. With new hose clamps, connect the radiator hoses.
13. Attach the grille and clearance lamps.
14. Fill the radiator with a water coolant mixture, start the engine and check for leaks.
15. Top off the coolant with the engine running.
16. On vehicles with automatic transmissions, check the level of the transmission fluid and adjust as needed. Some fluid may have been lost during removal.

1FZ-FE Engine

➧ **See Figures 110, 111, 112, 113, 114 and 115**

1. Drain the engine cooling system.
2. Disconnect the battery cables, negative first.
3. Remove the hold-down clamp and battery.
4. Unbolt and remove the ground strap.
5. Remove the battery tray.
6. Remove the grille.
7. Disconnect the radiator bypass hose.
8. Disconnect the upper radiator and reservoir hoses.
9. Loosen the water pump pulley mounting nuts.
10. Loosen the lock, pivot and adjusting bolts of the alternator, then remove the drive belts.
11. Disconnect the oil cooler hose from the clamp on the fan shroud.
12. Unbolt and remove the fan shroud.
13. Remove the water pump pulley mounting nuts.
14. Pull out the fan with the coupling, water pump pulley and fan shroud.
15. Disconnect the A/T oil cooler hoses.

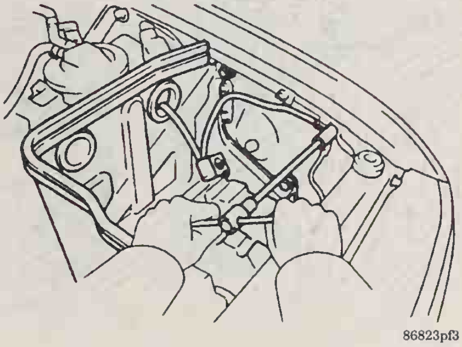

Fig. 111 The battery tray must be removed from the vehicle

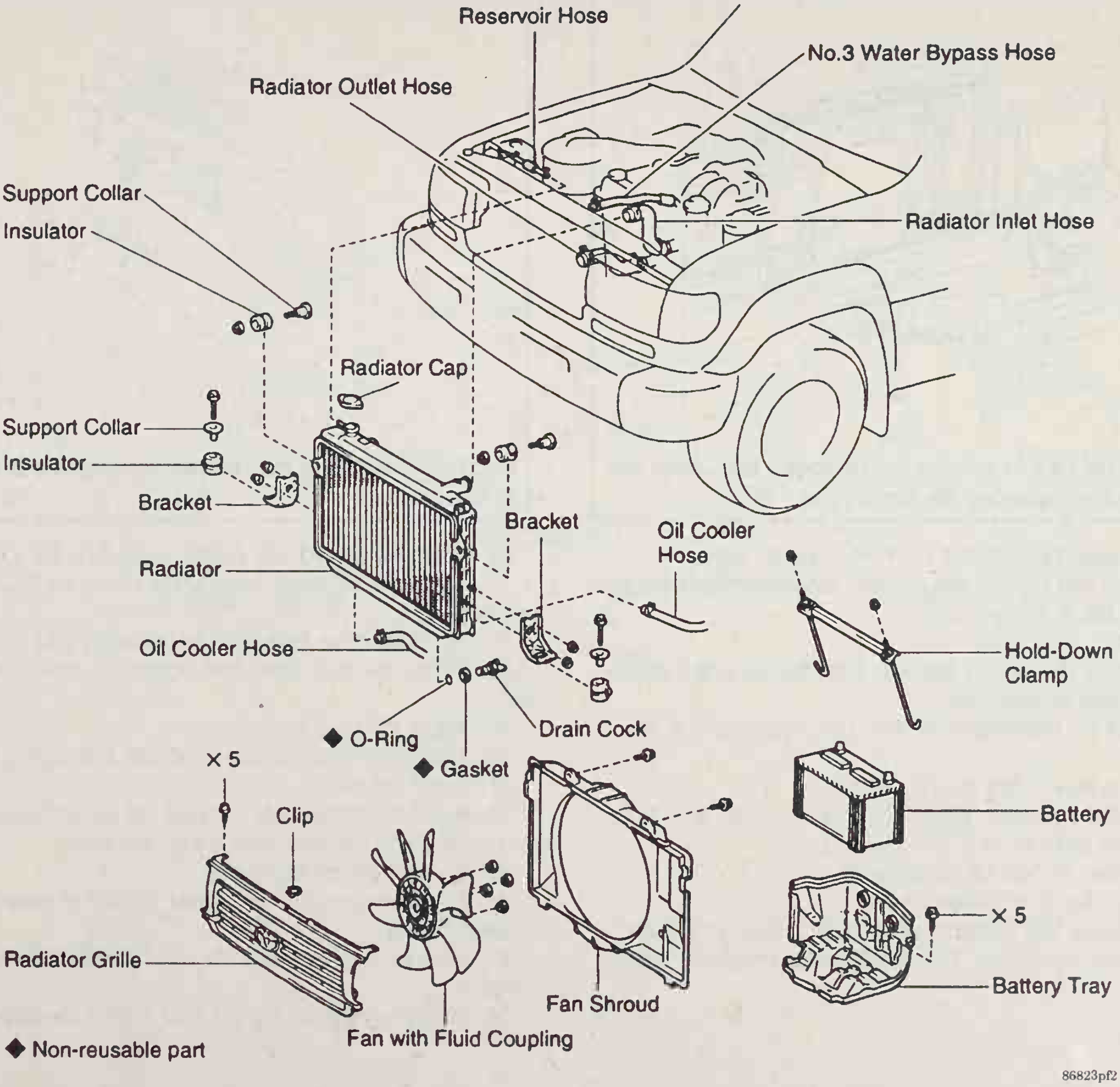
Reservoir Hose
No.3 Water Bypass Hose
Radiator Outlet Hose
Support Collar
Insulator
Radiator Inlet Hose
Radiator Cap
Support Collar
Insulator
Bracket
Bracket
Oil Cooler Hose
Radiator
Oil Cooler Hose
Hold-Down Clamp
◆ O-Ring
Drain Cock
× 5
◆ Gasket
Clip
Battery
× 5
Radiator Grille
Battery Tray
Fan Shroud
Fan with Fluid Coupling
◆ Non-reusable part
86823pf2

Fig. 110 Exploded view of the radiator mounting on 1FZ-FE engines

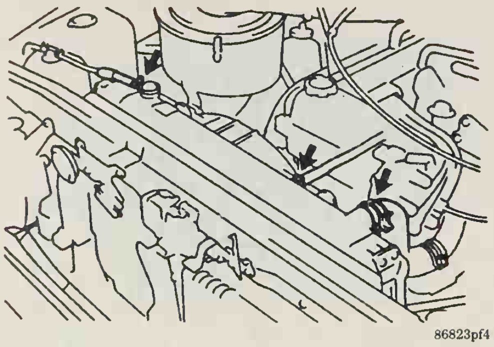

Fig. 112 Disconnect the indicated hoses from the radiator

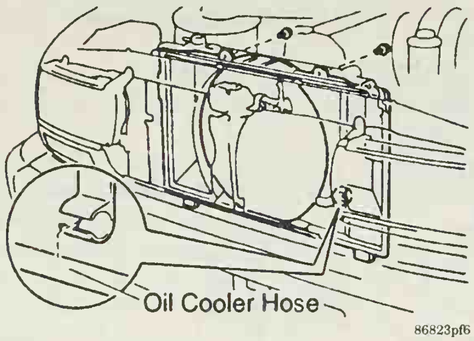

Fig. 113 Be sure to release the oil cooler hose from the clamp before removing the fan shroud

16. Unclamp, then remove the lower radiator hose.
17. Unbolt and remove the radiator, remember there will be some fluid still in the unit.

To install:

18. Remove the radiator brackets from the old unit if replacing with a new or used one.
19. Install the brackets to the new unit, tighten to 9 ft. lbs. (12 Nm).
20. Use a new O-ring on the petcock.
21. Install the radiator, tighten the mounting nuts to 9 ft. lbs. (12 Nm) and bolts to 13 ft. lbs. (18 Nm).
22. Connect the A/T oil cooler hoses.
23. Attach the lower radiator hose.
24. Place the fan, coupling, water pump pulley and shroud in position on the engine. Temporarily install the pulley mounting nuts.

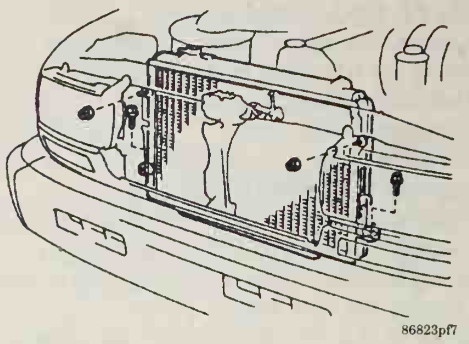

Fig. 114 Remove the fasteners securing the radiator, the remove the radiator from the vehicle

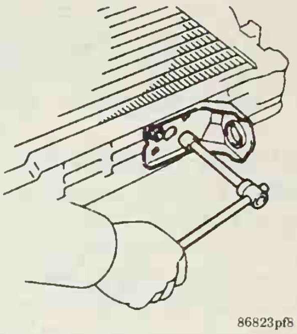

Fig. 115 If replacing the radiator, transfer the brackets to the new unit

25. Install the shroud and tighten to 43 inch lbs. (5 Nm).
26. Attach the oil cooler hose to the clamp on the fan shroud.
27. Install the drive belts with the adjusting and pivot bolts.
28. Stretch the belts tight, then tighten the pulley mounting nuts.
29. Adjust the drive belts.
30. Attach the reservoir, upper radiator and bypass hoses.
31. Install the grille.
32. Install the battery tray, connect the ground strap. Install the battery with the hold-down clamp and nuts.
33. Connect the battery cables.
34. Fill the engine with the correct amount of water and coolant mixture.
35. Start the engine, check for leaks and top off the coolant level.
36. Check and top off the A/T fluid level if needed.

Engine Oil Cooler

REMOVAL & INSTALLATION

3VZ-E Engine

See Figures 116 and 117

1. Drain the engine coolant.
2. Disconnect the oil cooler hoses.
3. On the 2WD vehicles, remove the 2 bolts, union bolt, relief valve, gaskets and oil cooler.
4. On 4WD vehicles, remove the center bolt, relief valve, gaskets and oil cooler.
5. Inspect the oil cooler for damage or clogging. If needed replace.

To install:

6. Replace the O-rings when installing the oil cooler.
7. On the 2WD vehicles, install the cooler with the relief valve, union bolt and 3 new gaskets. Tighten down to 43 ft.

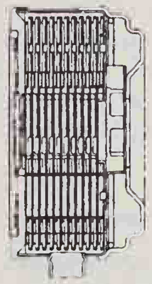

Fig. 117 Cross-sectional view of the oil cooler

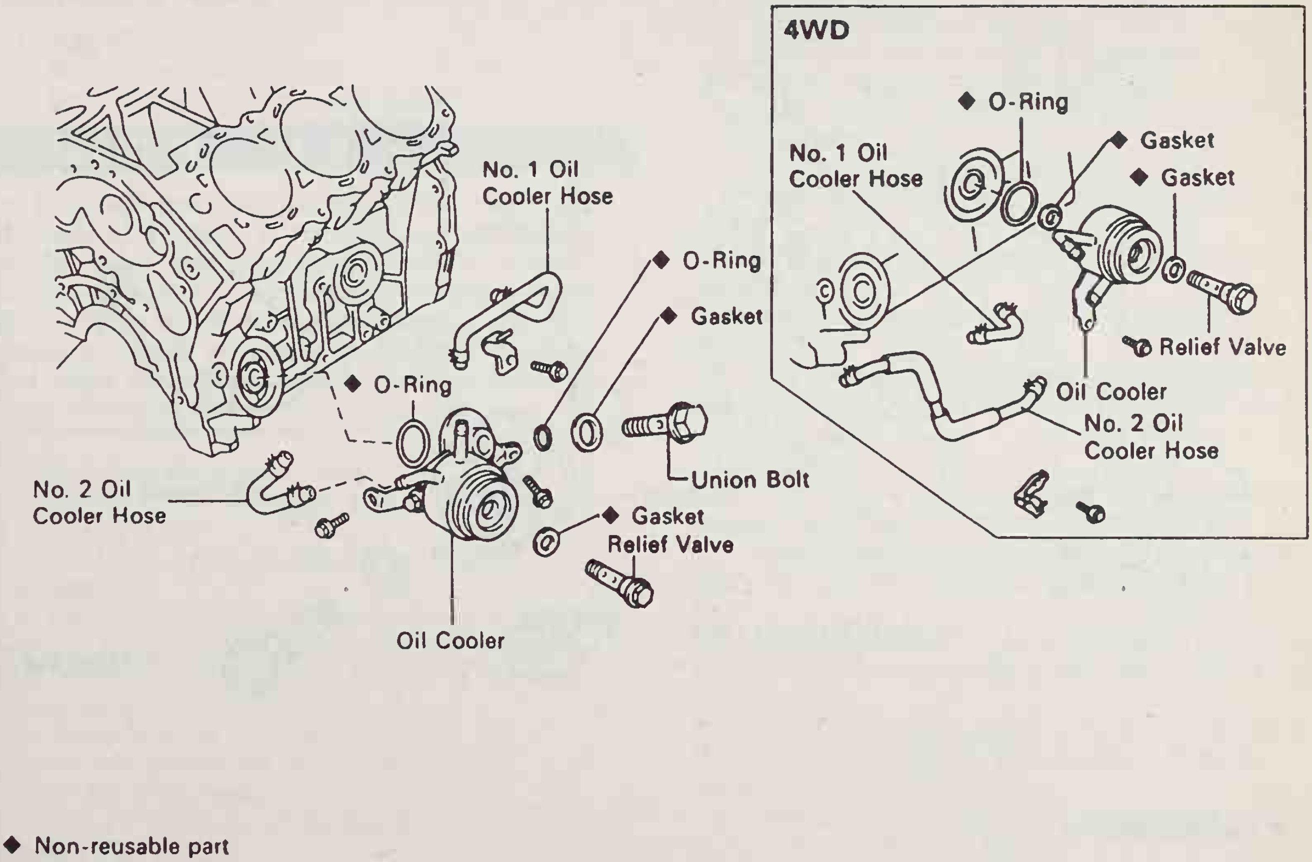
4WD
◆ O-Ring
No. 1 Oil Cooler Hose
◆ Gasket
◆ Gasket
Relief Valve
Oil Cooler
No. 2 Oil Cooler Hose
No. 1 Oil Cooler Hose
◆ O-Ring
◆ Gasket
◆ O-Ring
Union Bolt
No. 2 Oil Cooler Hose
◆ Gasket
Relief Valve
Oil Cooler
◆ Non-reusable part
86823pg0

Fig. 116 Exploded view of the oil cooler assembly found on 3VZ-E engines

lbs. (59 Nm). Install the other 2 bolts and tighten to 29 ft. lbs. (39 Nm).

8. On the 4WD vehicles, install the oil cooler with the relief valve and 2 new gaskets. Tighten to 43 ft. lbs. (59 Nm). Tighten the other 2 bolts to 29 ft. lbs. (39 Nm).
9. Connect the oil cooler hoses.
10. Fill the engine with a mixture of water and coolant. Start the engine, top off the fluid and check for leaks.
11. Recheck the engine oil level.

5VZ-FE Engine

➧ See Figures 118, 119 and 120

1. Drain the engine cooling system.
2. Disconnect the oil cooler hoses.
3. Remove the bolt, relief valve, gaskets and oil cooler.

To install:

4. Replace the O-ring on the oil cooler.
5. Use new gaskets for the relief valve.
6. Mount the cooler assembly and tighten to 43 ft. lbs. (59 Nm).
7. Attach the cooler hoses.

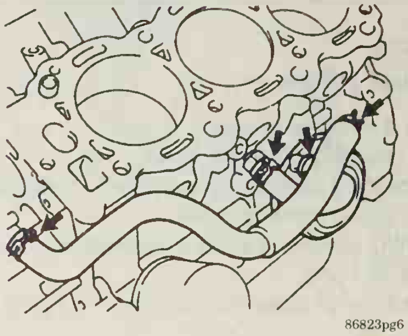

Fig. 119 Disconnect the hoses indicated

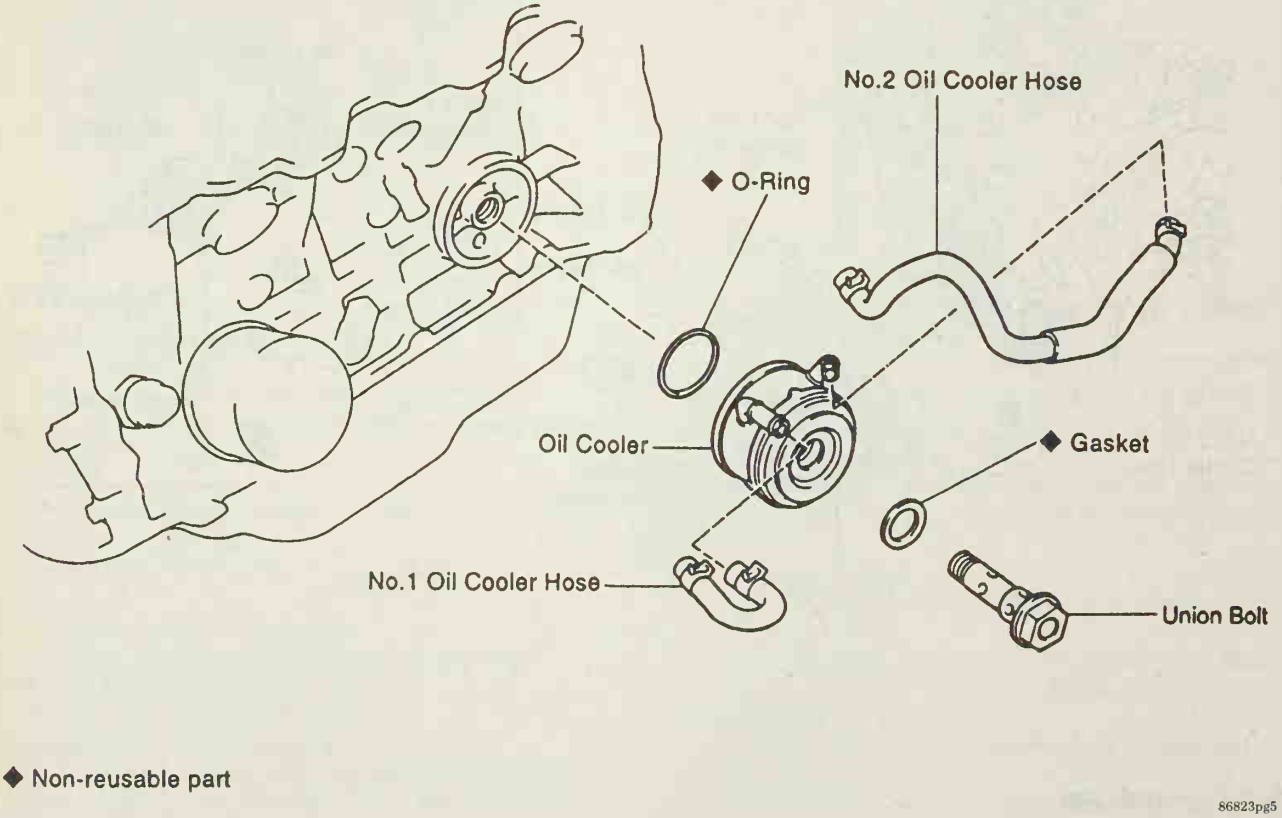
No.2 Oil Cooler Hose
◆ O-Ring
Oil Cooler
◆ Gasket
No.1 Oil Cooler Hose
Union Bolt
◆ Non-reusable part
86823pg5

Fig. 118 Exploded view of the oil cooler assembly found on 5VZ-FE engines

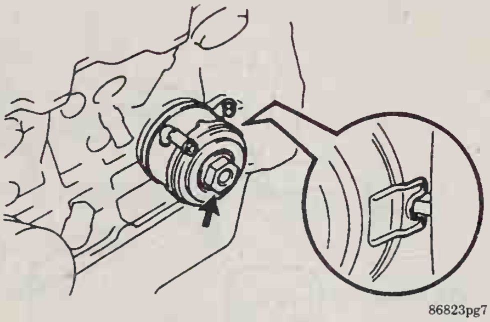

Fig. 120 Be sure the unit is properly positioned before tightening the union bolt

8. Fill the engine with a mixture of water and coolant. Start the engine, top off the fluid and check for leaks.
9. Recheck the engine oil level.

3F-E Engine

➧ See Figures 121 and 122

1. Drain the cooling system.
2. Remove the air cleaner hose.
3. Drain the engine oil and remove the filter.

⁂CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

4. Disconnect the oil cooler hoses.
5. Remove the two union bolts, gaskets, oil cooler and O-rings from the engine.
6. Check the oil cooler for damages or clogging.

To install:

7. Install the oil cooler by placing the O-rings in position on the cooler. Install the cooler with two new gaskets and the union bolts. Tighten the union bolts to 47 ft. lbs. (64 Nm).
8. Attach the oil cooler hoses.
9. Attach the air cleaner hose.
10. Fill the crankcase with new engine oil.
11. Fill the cooling system.
12. Start the engine, top off the coolant level. Check the engine oil level.
13. Check for leaks.

1FZ-FE Engine

➧ See Figures 123, 124, 125, 126, 127, 128 and 129

1. Drain the engine cooling system.
2. Remove the air cleaner lid.
3. Disconnect the heated oxygen sensor wiring.
4. Remove the nuts and bolts holding the front header pipe to the catalyst.
5. Unbolt the front pipe and remove the gasket.
6. Loosen the clamp bolt, then disconnect the clamp from the support bracket.
7. Remove the bolts and the support bracket.
8. Remove the nuts, exhaust pipe and gaskets.
9. Remove the bolts and the heat insulator.
10. Loosen the nuts for the exhaust manifold, then remove it and the gasket.
11. Unscrew the oil pressure switch.
12. Unbolt the oil cooler and cover assembly, discard of the gasket.
13. Remove the nuts, oil cooler and gaskets from the oil cooler cover.
14. Remove the plug, gasket, spring and relief valve from the unit.
15. Coat the relief valve with engine oil and check that it falls smoothly into the valve hole by its own weight. If not replace the valve.

To install:

16. Install the relief valve, spring, and new gasket along with the plug. Tighten the plug to 27 ft. lbs. (37 Nm).
17. Assemble the oil cooler and cover with 2 new gaskets. Attach the cover with the 4 nuts. Tighten to 12 ft. lbs. (17 Nm).
18. Install a new gasket, oil cooler and cooler cover assembly with the 10 bolts and 2 nuts, tighten them to 15 ft. lbs. (21 Nm).
19. Apply Loctite® or equivalent to the first 2-3 threads of the oil pressure sending unit, then install the unit into the engine.
20. Using a new gasket, attach the exhaust manifold to the engine, tighten to 29 ft. lbs. (39 Nm).
21. Install the heat insulator, tighten to 14 ft. lbs. (19 Nm).
22. To install the front header pipe, apply 2 new gaskets to the front of the pipe attach, then tighten to 46 ft. lbs. (63 Nm).
23. Install the support bracket, tighten to 17 ft. lbs. (24 Nm).
24. Connect the clamp and tighten the clamp bolt to 14 ft. lbs. (20 Nm).

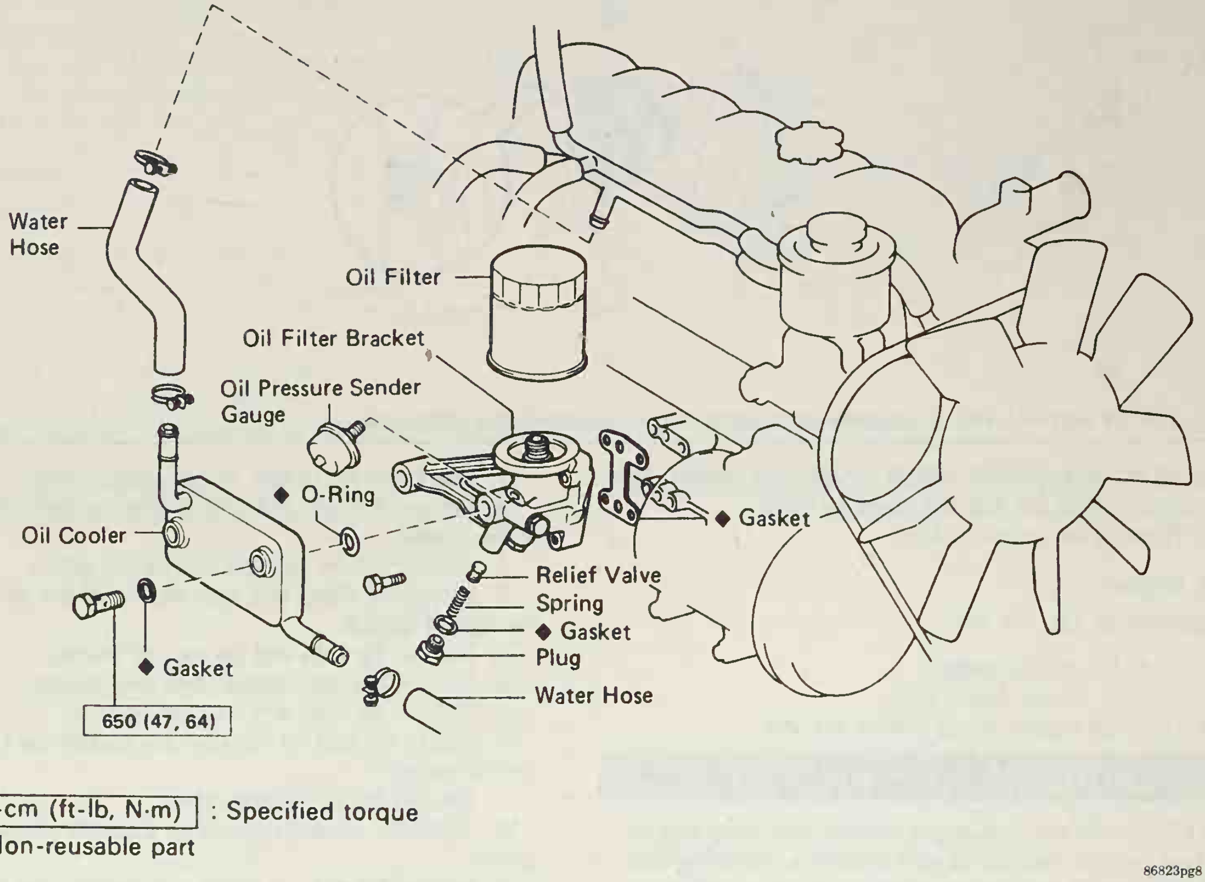
Water Hose
Oil Filter
Oil Filter Bracket
Oil Pressure Sender Gauge
◆ O-Ring
Oil Cooler
◆ Gasket
Relief Valve
Spring
◆ Gasket
Plug
◆ Gasket
Water Hose
650 (47, 64)
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86823pg8

Fig. 121 Exploded view of the oil cooler unit found on the 3F-E engine

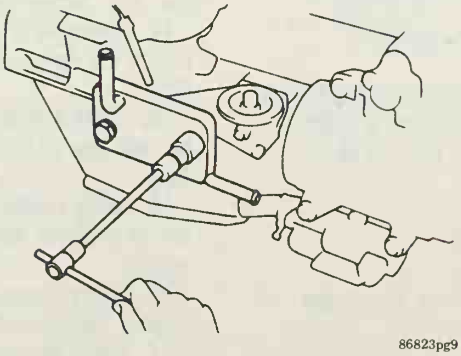

Fig. 122 Remove the two union bolts securing the oil cooler

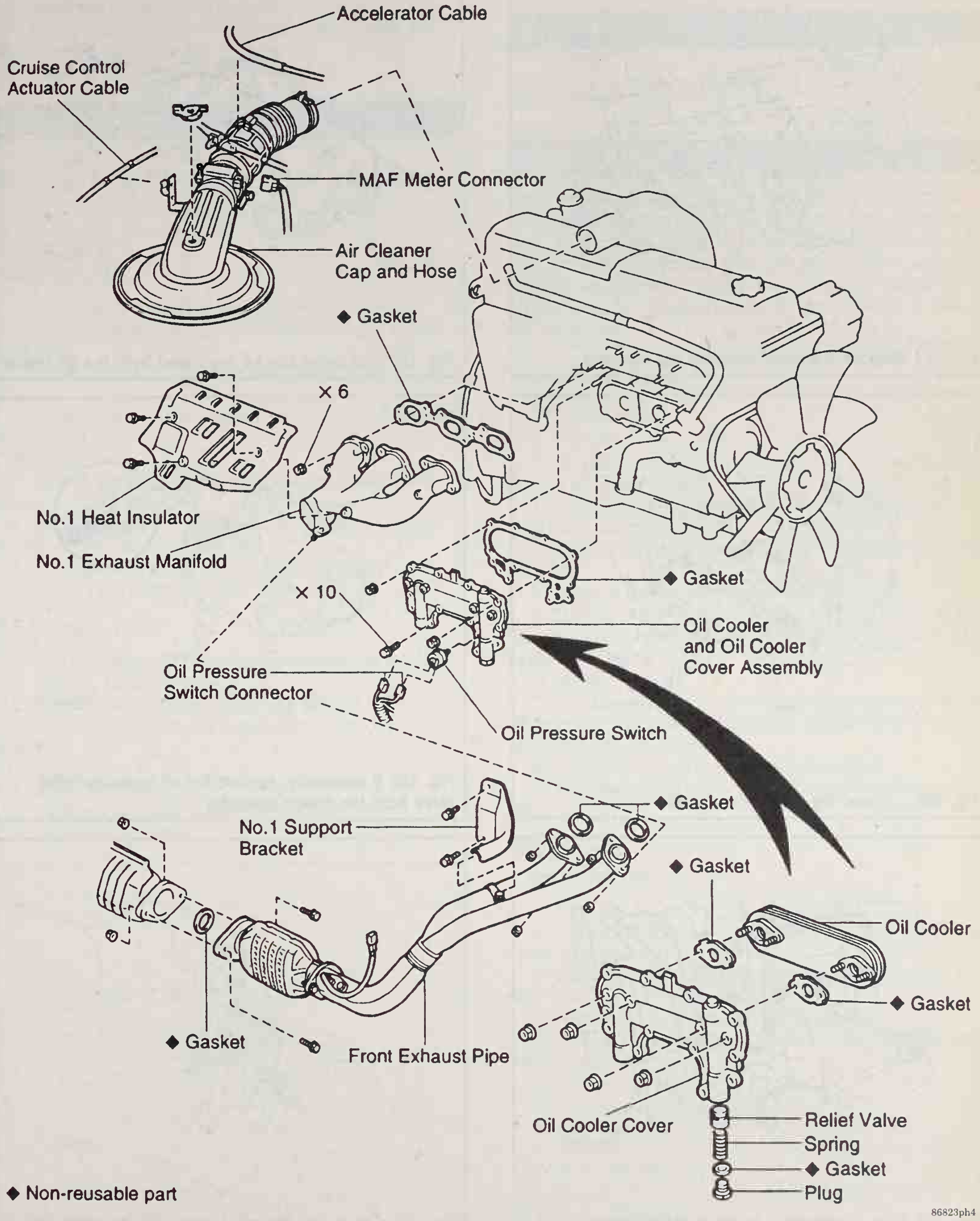
Accelerator Cable
Cruise Control Actuator Cable
MAF Meter Connector
Air Cleaner Cap and Hose
◆ Gasket
× 6
No.1 Heat Insulator
No.1 Exhaust Manifold
◆ Gasket
× 10
Oil Cooler and Oil Cooler Cover Assembly
Oil Pressure Switch Connector
Oil Pressure Switch
◆ Gasket
No.1 Support Bracket
◆ Gasket
Oil Cooler
◆ Gasket
◆ Gasket
Front Exhaust Pipe
Oil Cooler Cover
Relief Valve
Spring
◆ Gasket
Plug
◆ Non-reusable part
86823ph4

Fig. 123 Exploded view of the oil cooler and mounting

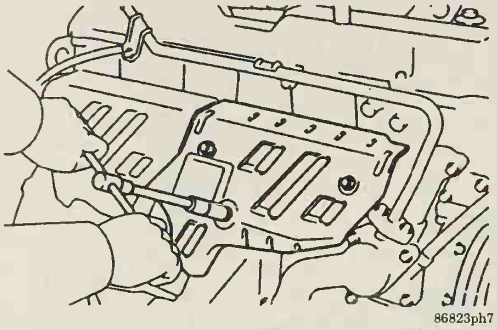

Fig. 124 Remove the bolts securing the insulator . . .

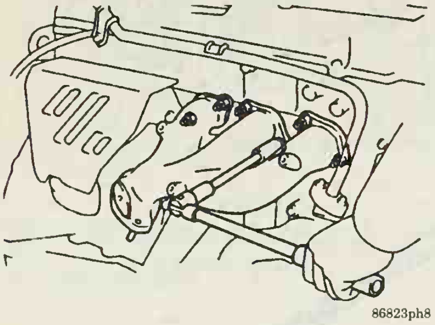

Fig. 125 . . . and the exhaust manifold

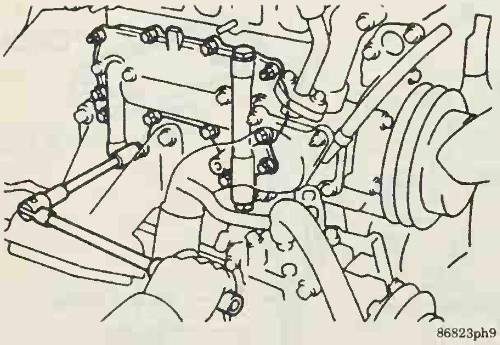

Fig. 126 Use an extension to reach the oil cooler mounting bolts

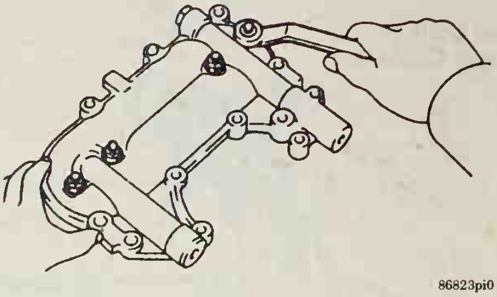

Fig. 127 The cover can be separated from the oil cooler

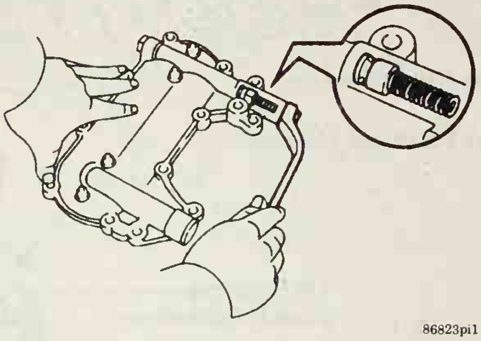

Fig. 128 If necessary, remove the oil pressure relief valve from the cooler assembly

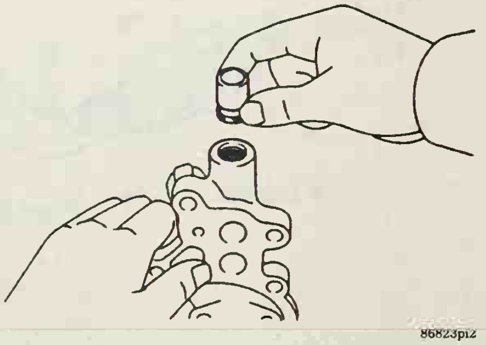

Fig. 129 Check that the relief valve falls smoothly into the hole under its own weight

25. Attach the front header pipe to the catalyst using new gaskets. Tighten to 34 ft. lbs. (46 Nm).
26. Install the air cleaner lid and hose.
27. Fill the radiator with a water coolant mixture, start the engine and top off the levels.
28. Check for leaks and check the engine oil.

Engine Cooling Fan

REMOVAL & INSTALLATION

Excluding 3F-E

➧ See Figure 130

1. Disconnect the negative battery cable.
2. Remove the alternator, A/C and power steering (if applicable) belts.
3. Loosen the bolts holding the water pump pulley (not the pump).
4. Remove the nuts, then remove the fan clutch (fluid coupling), fan and pulley.

To install:

5. Install the pulley, clutch and fan; loosely fit the nuts in place.
6. Install the drive belt to the water pump pulley. Tighten the nuts to 16 ft. lbs. (21 Nm).
7. Install the belts to the other pulleys and adjust.
8. Connect the negative battery cable.

3F-E Engine

1. With the ignition **OFF**, unplug the connector at the fan.
2. Remove the fan shroud.
3. Remove the air intake silencer and support.
4. Remove the 3 bolts and remove the cooling fan assembly.

To install:

5. Attach the cooling fan.
6. Install the air intake silencer and support.
7. Attach the fan shroud.

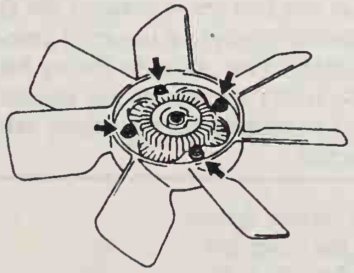

Fig. 130 There are four nuts retaining the fan blade to the fluid coupling

8. Plug in the fan connection.
9. Start the vehicle and check for operation.

Water Pump

REMOVAL & INSTALLATION

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

22R and 22R-E Engines

➧ See Figure 131

1. Drain the cooling system.
2. Unfasten the fan shroud securing bolts and remove the fan shroud, if so equipped.
3. Loosen the alternator adjusting bolt and remove the drive belt.
4. Remove the air conditioning and/or power steering pump drive belt.
5. Detach the bypass hose from the water pump.
6. Unfasten the water pump retaining bolts and remove the water pump and fan assembly, using care not to damage the radiator with the fan.

To install:

7. Install the water pump and tighten the mounting bolts to 27 ft. lbs. (37 Nm). Always use a new gasket between the pump body and its mounting.
8. Install the drive belts and adjust the tension.
9. Refill the cooling system, start the engine and check for leaks.

3F-E Engine

➧ See Figure 132

1. Drain the coolant from the engine and radiator.
2. Loosen the idler pulley and adjusting bolts to remove the power steering belt.
3. Disconnect the coolant reservoir hose and the radiator inlet hose.
4. Remove the bolts holding the fan shroud.
5. Remove the alternator drive belt, fan, fluid coupling, and water pump pulley.
6. Remove the alternator.
7. Remove the air conditioning belt.
8. Disconnect the four hoses from the water pump.
9. Remove bolt, two nuts and power steering idler pulley with the bracket assembly.
10. Remove the bolt and nut, alternator support bracket, water pump and gasket.

To install:

11. Install a new gasket, the water pump and alternator support bracket with the bolt and nut.

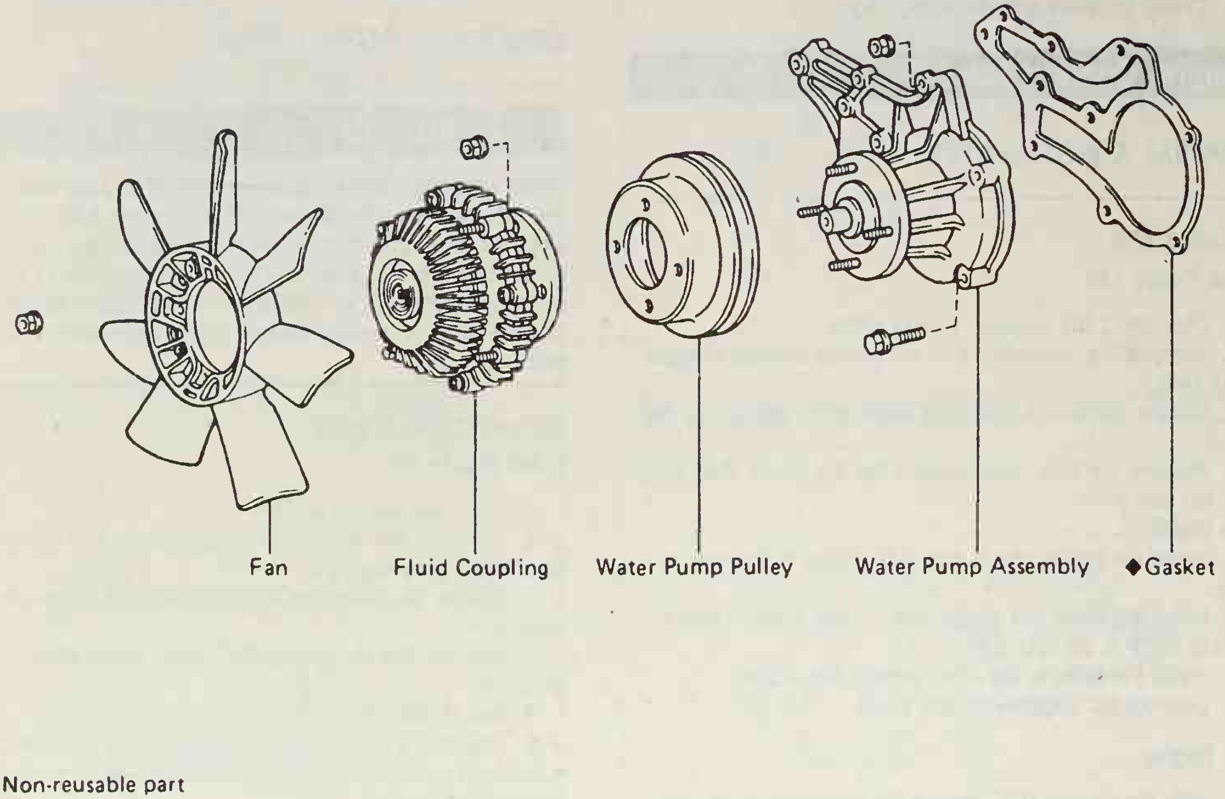

Fig. 131 Exploded view of the water pump mounting — 22R and 22R-E engines

12. Install the power steering idler pulley with the bracket assembly.
13. Tighten the water pump nuts and bolt to 27 ft. lbs. (37 Nm).
14. Install the air conditioning belt and adjust it.
15. Connect the hoses to the water pump.
16. Install the alternator.
17. Install the water pump pulley along with the fan and fluid coupling. Place the drive belt(s) onto each pulley; press down to tighten the belts against the pulley and tighten the four nuts. Adjust the belt tension.
18. Install the fan shroud bolts.
19. Attach the radiator inlet hose and connect the reservoir hose.
20. Install and adjust the power steering belt.
21. Install the proper amount of coolant in the system.
22. Start the engine and check for leaks.

3VZ-E and 5VZ-FE Engines

▸ See Figures 133 and 134

⁂WARNING

This procedure requires the removal of the timing belt. This is an extensive procedure requiring precision work, particularly at reassembly. Refer to Timing Belt — Removal and Installation in this section. Do not attempt to remove the belt without consulting the procedure; extreme engine damage may occur.

1. Drain the cooling system.
2. Remove the timing belt.
3. Remove the idler pulley.
4. Remove the thermostat.
5. Disconnect the oil cooler hose from the pump.
6. Remove the seven bolts and the tension spring bracket and then remove the water pump.

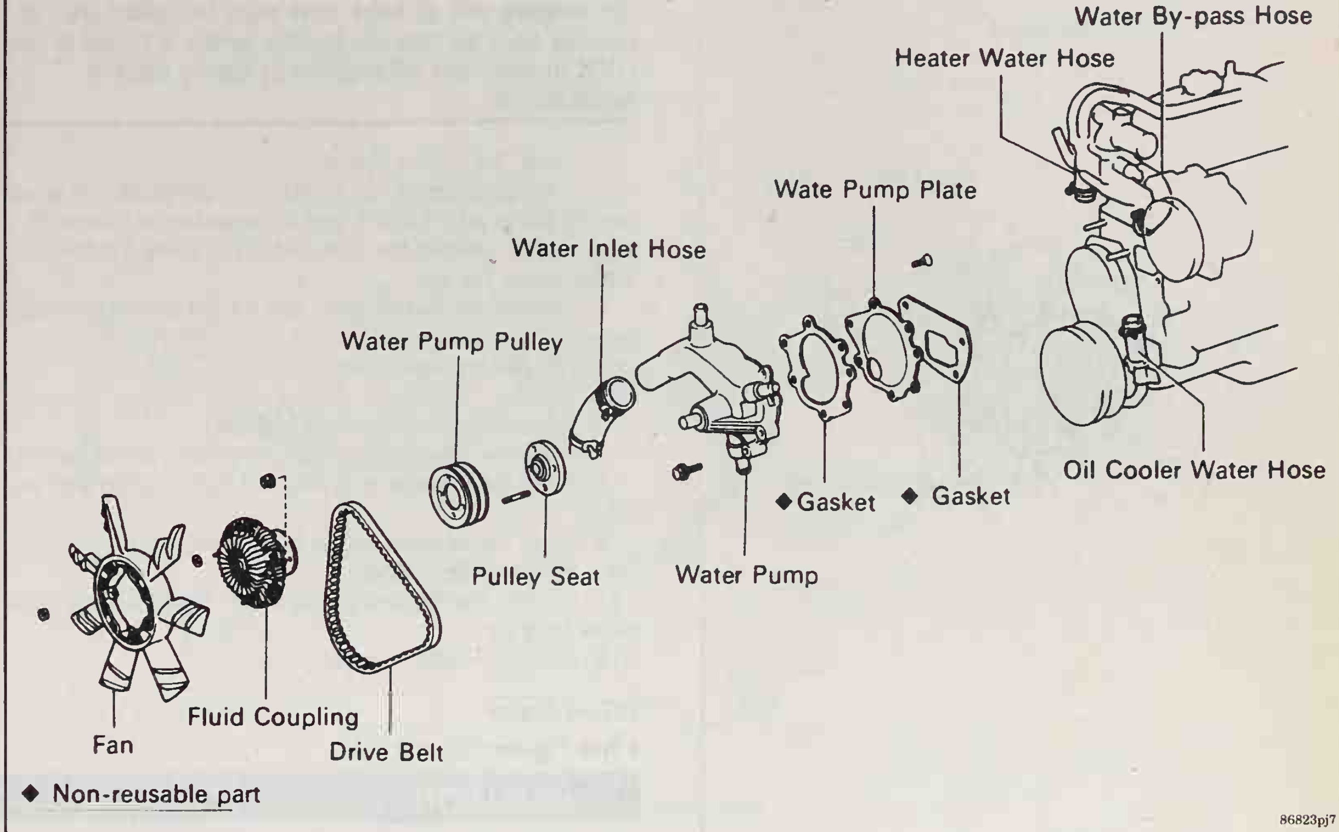
Water By-pass Hose
Heater Water Hose
Wate Pump Plate
Water Inlet Hose
Water Pump Pulley
Oil Cooler Water Hose
◆Gasket
◆ Gasket
Pulley Seat
Water Pump
Fluid Coupling
Fan
Drive Belt
◆ Non-reusable part
86823pj7

Fig. 132 Exploded view of the water pump mounting on the 3F-E engine

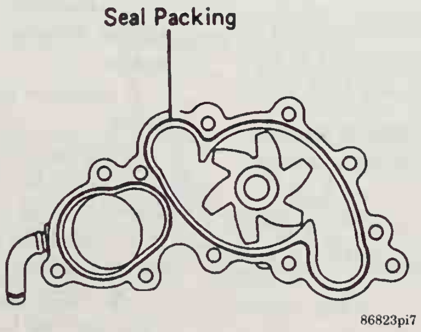
Seal Packing
86823pi7

Fig. 133 Apply sealant to the areas shown

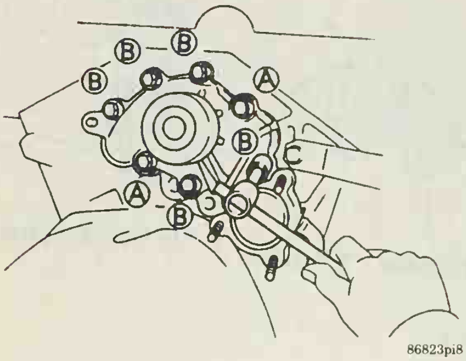

Fig. 134 A and B bolt locations

To install:

7. Remove any old packing from the pump and mounting area of the engine. Be careful not to drop any oil on the mating areas.
8. Apply sealer to the pump-to-block mating surface and then tighten the bolts marked **A** in the illustration to 13 ft. lbs. (18 Nm). Tighten those marked **B** to 14 ft. lbs. (20 Nm).

➡The parts must be installed within 5 minutes of application of the sealant. Otherwise you must remove and reapply the sealer.

9. Connect the oil cooler hose.
10. Install the thermostat with a new gasket.
11. Install the idler pulley.
12. Install the timing belt.
13. Install the drive belts and adjust the tension.
14. Refill the cooling system and check for leaks.

2RZ-FE and 3RZ-FE Engines

1. Disconnect the negative battery cable.

✻✻CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Drain the cooling system.
3. If equipped with an air conditioning compressor or power steering pump drive belts, it may be necessary to loosen the adjusting bolt, remove the drive belt(s) and move the component(s) out of the way.
4. Remove the fluid coupling with the fan and water pump pulley.
5. Remove the water pump.

To install:

6. Clean the gasket mounting surfaces.
7. Install the replacement water pump using a new gasket.
8. Install the water pump pulley and fluid coupling with the fan.
9. Install the removed engine drive belts.
10. Fill the cooling system.
11. Connect the negative battery cable. Start the engine and check for leaks.
12. Bleed the cooling system.

1FZ-FE Engine

➧ See Figures 135 and 136

✻✻CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Disconnect the water bypass and radiator inlet hoses.
4. Remove the drive belts, fan assembly, and the fan shroud.
5. Disconnect the oil cooler hose from the clamp on the fan shroud. Remove the bolts holding the fan shroud to the radiator.
6. Remove the 4 bolts, 2 nuts, water pump, and the gasket.

To install:

7. Install the water pump using a new gasket. Tighten the fasteners to 15 ft. lbs. (21 Nm).
8. Install the water pump pulley, fan shroud, and the drive belts as follows:
    a. Place the fan with the fluid coupling, water pump pulley, and the fan shroud in position.
    b. Temporarily install the fan pulley mounting nuts.
    c. Install the fan shroud and tighten the bolts to 43 inch lbs. (5 Nm).
    d. Connect the oil cooler hose to the clamp on the fan shroud.

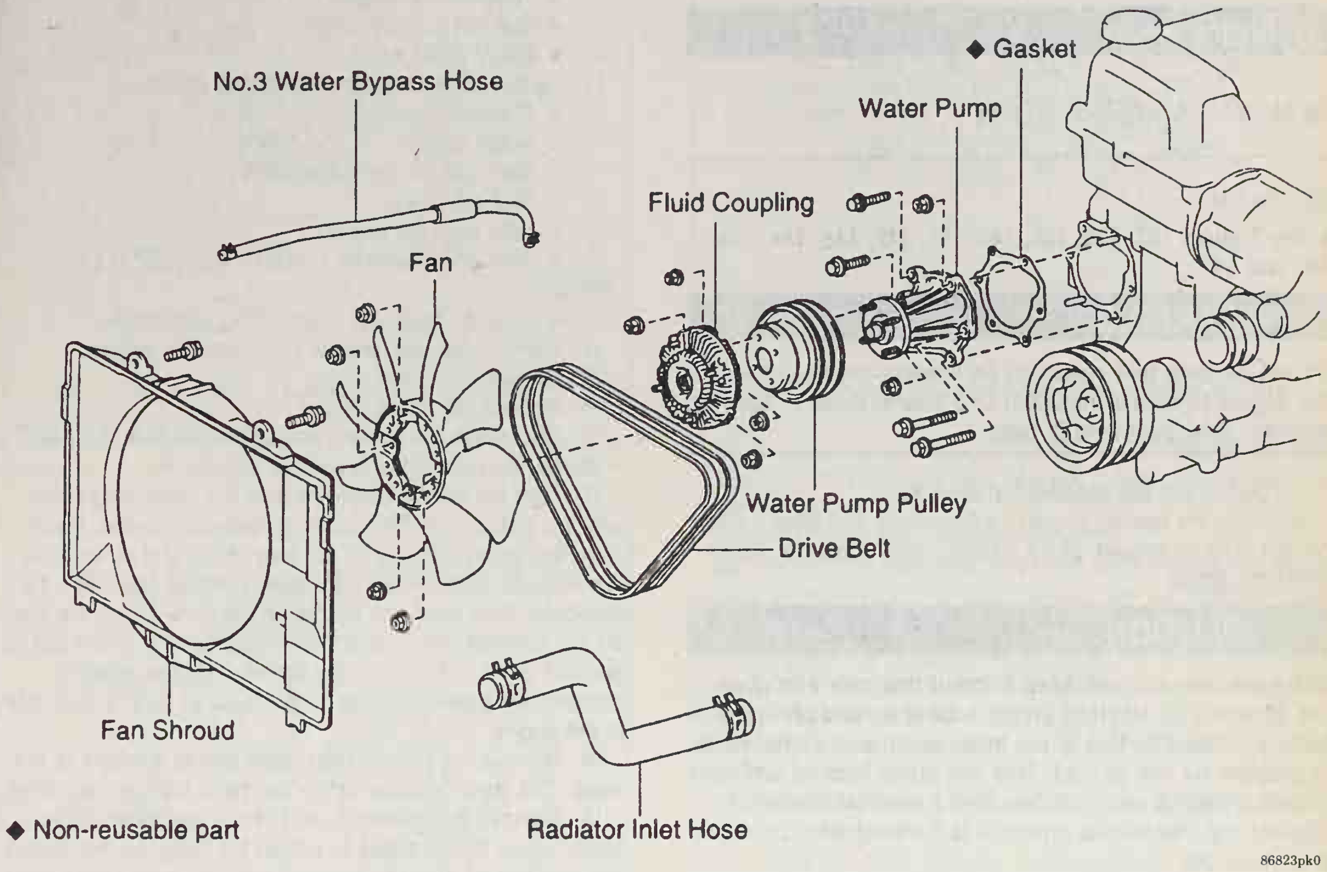
◆ Gasket
No.3 Water Bypass Hose
Water Pump
Fluid Coupling
Fan
Water Pump Pulley
Drive Belt
Fan Shroud
◆ Non-reusable part
Radiator Inlet Hose
86823pk0

Fig. 135 Exploded view of the water pump mounting on the 1FZ-FE engine

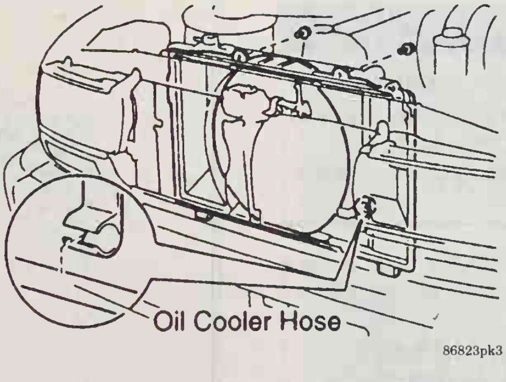
Oil Cooler Hose
86823pk3

Fig. 136 Detach the oil cooler hose from the clamp on the fan shroud

9. Connect the water bypass and radiator hoses. Fill the cooling system.
10. Connect the negative battery cable.
11. Start the engine, check for leaks and top off the fluids.

Cylinder Head

REMOVAL & INSTALLATION

22R Engine

See Figures 137, 138, 139, 140, 141, 142, 143, 144, 145, 146 and 147

WARNING

Do not perform this operation on a warm engine. Allow the engine to cool a minimum of 3 hours, more in hot weather. Overnight cold is best.

1. Disconnect the negative battery cable.
2. Drain the cooling system (both radiator and block). If the coolant is to be reused, place a large, clean container underneath the drains.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Remove the three exhaust pipe flange nuts and separate the pipe from the manifold.
4. Remove the air cleaner assembly, complete with hoses, from the carburetor.

Cover the carburetor with a clean shop cloth so that nothing can fall into it.

5. Drain the engine oil.

CAUTION

Used motor oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Although this is unlikely unless you handle oil on a daily basis, it is wise to thoroughly wash your hands with soap and water immediately after handling used motor oil.

6. Disconnect the radiator inlet hose from the water outlet.
7. If equipped with an air pump, disconnect the air hose from the check valve.
8. Disconnect the two heater hoses from the engine.
9. Disconnect the accelerator cable at the carburetor.
10. Label and disconnect these wires:
    - EGR temperature sensor (Calif. vehicles only)
    - Water temperature gauge sender
    - Cold mixture heater wire
    - Temperature sensor
    - Fuel cut solenoid valve
    - EACV (Calif. only)
11. Label and disconnect these hoses and lines:
    - Charcoal canister
    - Brake booster
    - Main fuel line from fuel inlet
    - Fuel return line
    - HAC from the bracket
    - Electronic Bleed Air Control Valve (EBCV) Calif. vehicles
    - Vacuum Switching Valve (VSV) with bracket
12. Remove the rear ground strap from the engine.
13. Remove the distributor.
14. Remove the spark plugs.
15. Disconnect the power steering bracket from the head.
16. Remove the valve cover and gasket.
17. Turn the engine clockwise (use the crank pulley bolt) until the piston is at TDC on its compression stroke. Matchmark the timing sprocket to the cam chain, and remove the semi-circular plug. Remove the cam sprocket bolt. Slide the distributor drive gear and spacer off the cam. Leave the chain on the sprocket; either wire the cam sprocket in place just off the end of the cam or rest the sprocket on the vibration damper. Tie a string or wire to the chain to keep it from falling in the engine.
18. Remove the timing chain cover bolt at the front of the head. This must be done before the head bolts are removed.
19. Remove the cylinder head bolts in the correct order. Make two or three passes to loosen the bolts. Do not loosen any one bolt all at once; improper removal could cause head damage.
20. Using prybars applied evenly at the front and the rear of the valve rocker assembly, gently pry the assembly off its mounting dowels.
21. Lift the head off its dowels. If it is difficult to lift off, pry gently with small tools. Do NOT damage the mating surfaces

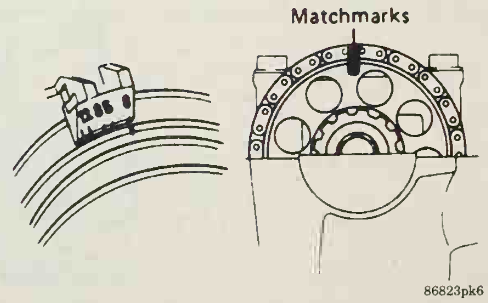

Fig. 137 Set the timing marks to TDC on the No.1 cylinder; matchmark the chain and sprocket

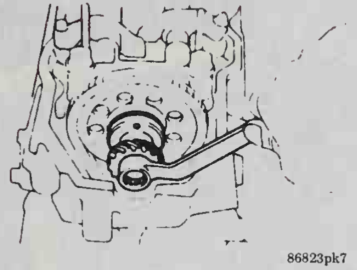

Fig. 138 Using a 19mm wrench, remove the cam sprocket bolt

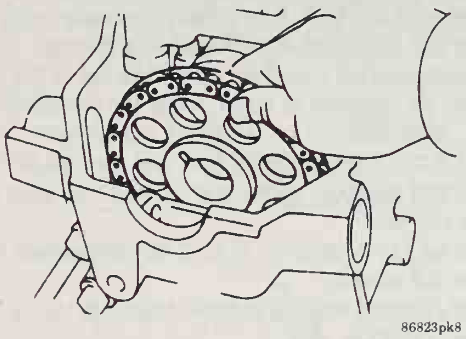

Fig. 139 Do not allow the chain to slip off while removing the sprocket

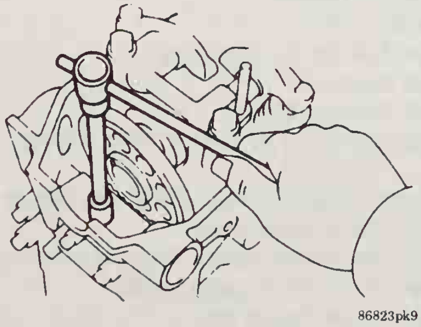

Fig. 140 Remove the front cover bolt before loosening the cylinder head bolts

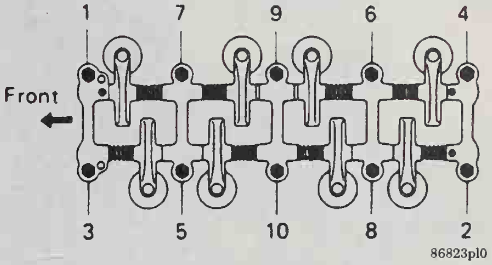

Fig. 141 Loosen the head bolts in this order, in three passes

of the head or block. Do NOT attempt to slide the head off the block; it must be lifted.

22. Support the head on a workbench.

23. Remove the manifolds and EGR valve from the head on the workbench. Keep the head covered and the manifold ports plugged with rags when not working on it.

24. Re-drain the oil pan after the head has been removed; coolant will have spilled into the pan during head removal. The coolant will pollute the oil.

25. Remove the head gasket, never reuse the old one.

To install:

26. Apply liquid sealer to the front corners of the block and install the head gasket.

27. Lower the head over the locating dowels. Do not attempt to slide it into place.

28. Install the rocker arm assembly over its positioning dowels.

29. Install the cylinder head bolts. Tighten the bolts sequentially in three passes and in the correct order, coming to final torque on the last pass. Correct tightness is 58 ft. lbs. (78 Nm)

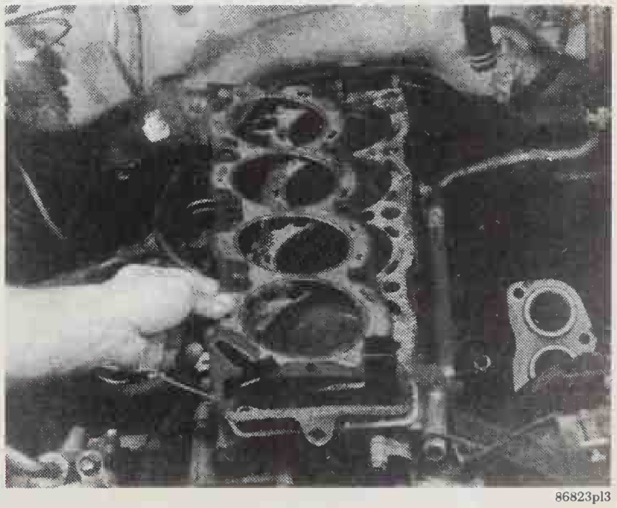

Fig. 142 Lift the old gasket from the block

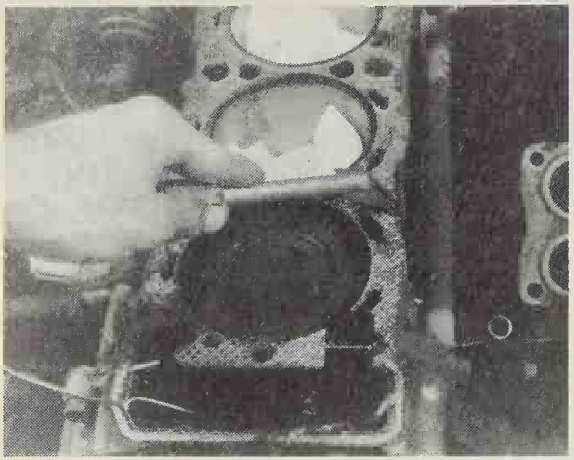

Fig. 143 Scrape and clean the area well, insert paper into the cylinder walls to keep dirt from entering

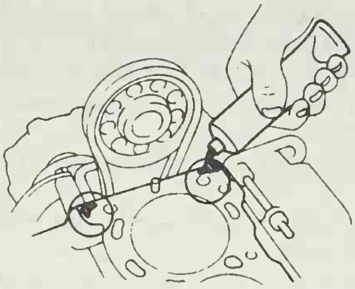

Fig. 144 Apply liquid sealer to the corners of the block

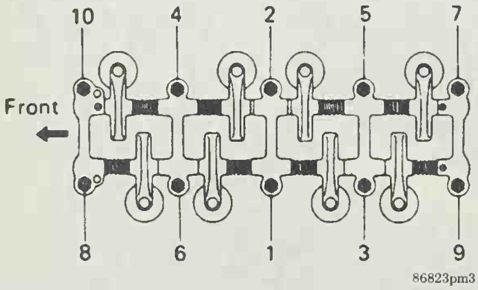

Fig. 145 Tighten the head bolts in this order, in three passes

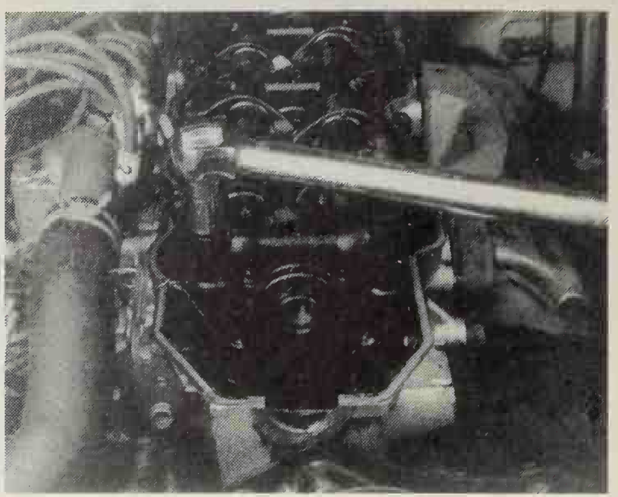

Fig. 146 Always tighten the bolts with a torque wrench

30. Install the chain cover bolt. Tighten it to 9 ft. lbs. (13 Nm).
31. Hold the chain and sprocket; double check that the engine is set to No. 1 TDC. If necessary, manually rotate the engine so that the sprocket hole is also at the top.
32. Fit the sprocket over the camshaft dowel. If the chain won't allow the sprocket to reach, rotate the crankshaft back and forth, while lifting up on the chain and sprocket.
33. Install the distributor drive gear and cam thrust plate over the chain sprocket; tighten the camshaft sprocket bolt to 58 ft. lbs. (78 Nm).
34. Set the No. 1 piston at TDC of its compression stroke and adjust the valves.
35. Apply sealant only the cylinder head side of the half-circle plug; install the plug.
36. Install the valve cover
37. Attach the power steering bracket and compressor support to the cylinder head. Tighten the bolts to 33 ft. lbs. (44 Nm)
38. Install the power steering belt and adjust the tension.
39. Install the distributor. Install the spark plugs.
40. Connect the rear ground strap.
41. Install the lines and hoses disconnected:
    - Charcoal canister
    - Brake booster
    - Main fuel line from fuel inlet
    - Fuel return line
    - HAC from the bracket
    - Electronic Bleed Air Control Valve (EBCV) Calif. vehicles
    - Vacuum Switching Valve (VSV) with bracket
42. Connect the wires removed:
    - EGR temperature sensor (Calif. vehicles only)
    - Water temperature gauge sender
    - Cold mixture heater wire
    - Temperature sensor
    - Fuel cut solenoid valve
    - EACV (Calif. only)
43. Attach the accelerator cable.
44. Connect the air pump hose to the check valve if it was removed.

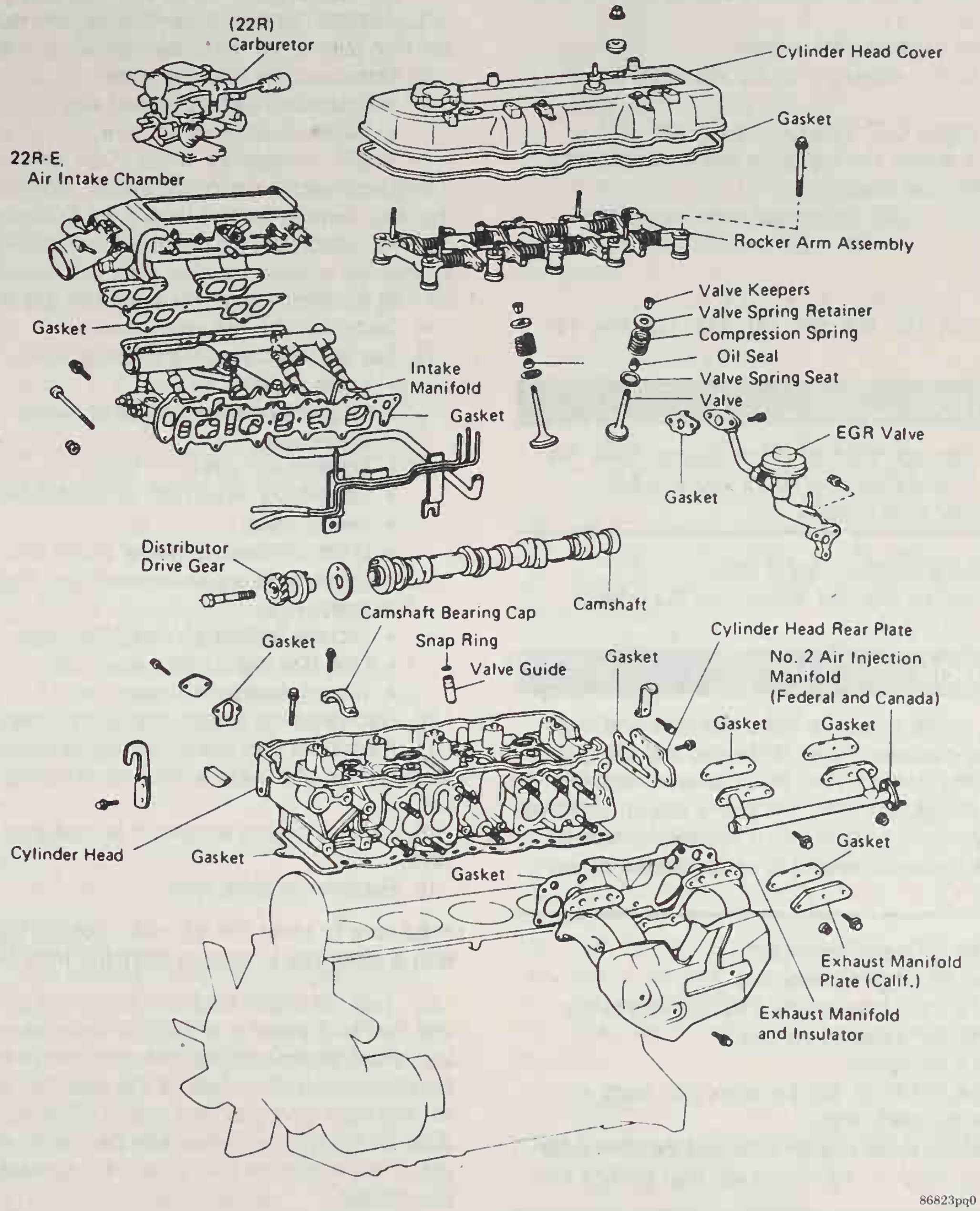
(22R)
Carburetor
22R-E,
Air Intake Chamber
Gasket
Intake
Manifold
Gasket
Distributor
Drive Gear
Camshaft Bearing Cap
Camshaft
Cylinder Head Cover
Gasket
Rocker Arm Assembly
Valve Keepers
Valve Spring Retainer
Compression Spring
Oil Seal
Valve Spring Seat
Valve
EGR Valve
Gasket
Gasket
Snap Ring
Valve Guide
Gasket
Cylinder Head Rear Plate
No. 2 Air Injection
Manifold
(Federal and Canada)
Gasket
Gasket
Gasket
Cylinder Head
Gasket
Gasket
Exhaust Manifold
Plate (Calif.)
Exhaust Manifold
and Insulator
86823pq0

Fig. 147 Exploded view of the cylinder head components on the 22R and 22R-E engines

45. Connect the 2 heater hoses and install the radiator hose to the water outlet.
46. Use a new gasket and connect the exhaust pipe to the manifold. New nuts are recommended.
47. Install the air cleaner and connect the hoses.
48. Refill the engine oil and engine coolant.
49. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.
50. Connect the negative battery cable.
51. Start the engine, allowing it to idle and warm up gradually.
52. Shut the engine **OFF**. Readjust the valves.
53. Restart the engine and adjust the timing as necessary.
54. Recheck the fluid levels.
55. Road test the vehicle for general performance and driveability.

22R-E Engine

➧ See Figures 137, 138, 139, 140, 141, 142, 143, 144, 145, 146 and 147

⁂CAUTION

Never perform this operation on a hot engine. Allow the engine to cool a minimum of 3 hours, more in hot weather. Overnight cold is best.

1. Disconnect the negative battery cable.
2. Drain the coolant from the radiator and the cylinder block. Drain the engine oil.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Remove the air intake connector.
4. Disconnect the oxygen sensor wire.
5. Remove the three nuts attaching the manifold to the exhaust pipe and then separate the two.
6. Remove the oil dipstick.
7. Remove the distributor with the spark plug leads attached. Remove the spark plugs.
8. Disconnect the upper radiator hose and the two heater hoses where they attach to the engine and then position them out of the way.
9. Disconnect the actuator cable, the accelerator cable and the throttle cable for the automatic transmission at their brackets.
10. Tag and disconnect the following:
    - Both PCV vacuum hoses
    - Brake booster hose
    - Actuator hose (if equipped with cruise control)
    - Air control valve hoses (with power steering)
    - Vacuum Switching Valve (VSV) hoses (with air conditioning)
    - Evaporative emissions (EVAP) hoses
    - EGR valve hose
    - fuel pressure hose
    - Reed valve hose
    - Pressure regulator hose
    - Vacuum hoses from throttle body
    - Water bypass hoses from throttle body
11. Tag and disconnect the EGR vacuum modulator hoses and then remove the modulator itself along with the bracket.
12. Disconnect the following wires:
    - Cold start injector pipe and wire
    - Throttle position sensor wire
    - EGR temperature sensor (Calif. vehicles)
13. Disconnect the cold start injector pipe from the intake chamber. Remove the bolt holding the EGR pipe to the air chamber. Disconnect the chamber from the stay. Remove the air chamber-to-intake manifold bolts and then lift off the chamber with the throttle body, resonator and gasket.
14. Disconnect the fuel return hose.
15. Tag and disconnect the following wires:
    - Knock sensor
    - Oil pressure sender gauge or switch
    - Starter wire
    - Transmission wires
    - Compressor wires (with air conditioning)
    - Injector wires
    - Water temperature sender gauge wire
    - Overdrive temperature switch wire (auto. trans.)
    - Igniter wire
    - Vacuum Switching Valve (VSV) wires
    - Cold start injector time switch wire
    - Water temperature sensor wire
16. Disconnect the bypass hose at the intake manifold.
17. If equipped with power steering, remove the pump and position it out of the way without disconnecting the hydraulic lines.
18. Remove the power steering bracket from the cylinder head.
19. Remove the valve cover.

➡Be sure to cover the oil return hole in the cylinder head with a clean rag to prevent anything from falling in.

20. Turn the engine clockwise (use the crank pulley bolt) until the No. 1 piston is at TDC on its compression stroke. Matchmark the timing sprocket to the cam chain, and remove the semi-circular plug. Remove the cam sprocket bolt. Slide the distributor drive gear and spacer off the cam. Leave the chain on the sprocket; either wire the cam sprocket in place just off the end of the cam or rest the sprocket on the vibration damper.
21. Remove the timing chain cover bolt at the front of the head. This must be done before the head bolts are removed.
22. Remove the cylinder head bolts in the correct order. Make two or three passes to loosen the bolts. Do not loosen any one bolt all at once; improper removal could cause head damage.

➡Refer to the bolt removal diagram for the 22R engine. All illustrations for the 22R are valid for the 22R-E.

23. Using prybars applied evenly at the front and the rear of the valve rocker assembly, gently pry the assembly off its mounting dowels.

24. Lift the head off its dowels. If it is difficult to lift off, pry gently with small tools. Do NOT damage the mating surfaces of the head or block. Do NOT attempt to slide the head off the block; it must be lifted.

25. Support the head on a workbench.

26. Remove the manifolds and EGR valve from the head on the workbench. Keep the head covered and the manifold ports plugged with rags when not working on it.

27. Re-drain the oil pan after the head has been removed; coolant will have spilled into the pan during head removal. The coolant will pollute the oil.

To install:

28. Apply liquid sealer to the front corners of the block and install the head gasket.

29. Lower the head over the locating dowels. Do not attempt to slide it into place.

30. Install the rocker arm assembly over its positioning dowels.

31. Install the cylinder head bolts. Tighten the bolts sequentially in three passes and in the correct order, coming to final torque on the last pass. Correct tightness is 58 ft. lbs. (78 Nm)

➡Refer to the bolt tightening diagram for the 22R engine. All illustrations for the 22R are valid for the 22R-E.

32. Install the chain cover bolt. Tighten it to 9 ft. lbs. (13 Nm).

33. Hold the chain and sprocket; double check that the engine is set to No. 1 TDC. If necessary, manually rotate the engine so that the sprocket hole is also at the top.

34. Fit the sprocket over the camshaft dowel. If the chain won't allow the sprocket to reach, rotate the crankshaft back and forth, while lifting up on the chain and sprocket.

35. Install the distributor drive gear and cam thrust plate over the chain sprocket; tighten the camshaft sprocket bolt to 58 ft. lbs. (78 Nm).

36. Set the No. 1 piston at TDC of its compression stroke and adjust the valves.

37. Apply sealant only the cylinder head side of the half-circle plug; install the plug.

38. Install the valve cover.

39. Attach the power steering bracket to the head; tighten the 4 bolts to 33 ft. lbs. (44 Nm).

40. Install the power steering pump and belt. Adjust the belt.

41. Connect the bypass hose to the intake manifold.

42. Connect the fuel hose to the delivery pipe. Tighten the bolt to 33 ft. lbs. (44 Nm).

43. Connect the wires removed:
- Knock sensor
- Oil pressure sender gauge or switch
- Starter wire
- Transmission wires
- Compressor wires (with air conditioning)
- Injector wires
- Water temperature sender gauge wire
- Overdrive temperature switch wire (auto. trans.)
- Igniter wire
- Vacuum Switching Valve (VSV) wires
- Cold start injector time switch wire
- Water temperature sensor wire
- Cold start injector pipe and wire
- Throttle position sensor wire
- EGR temperature sensor (Calif. vehicles)

44. Connect the fuel return hose.

45. Position new gaskets on the intake manifold and EGR pipe. Install the air intake chamber, throttle body and resonator. Install the bolts holding the EGR valve to the chamber. Use a new gasket and install the cold start injector pipe.

46. Connect the throttle position wire, the cold start injector wire and the EGR temperature sensor wire (Calif. only)

47. Install the EGR vacuum modulator.

48. Connect the hoses removed:
- Both PCV vacuum hoses
- Brake booster hose
- Actuator hose (if equipped with cruise control)
- Air control valve hoses (with power steering)
- Vacuum Switching Valve (VSV) hoses (with air conditioning)
- Evaporative emissions (EVAP) hoses
- EGR valve hose
- Fuel pressure hose
- Reed valve hose
- Pressure regulator hose
- Vacuum hoses from throttle body
- Water bypass hoses from throttle body

49. Connect the rear ground strap.

50. Connect the throttle and accelerator cables.

51. Install the heater hoses and the radiator inlet hose.

52. Install the spark plugs and the distributor. Install the engine oil dipstick.

53. Use new gaskets and connect the exhaust pipe to the manifold. Don't forget the clamp.

54. Install the air intake connector

55. Refill the engine oil and engine coolant.

56. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.

57. Connect the negative battery cable.

58. Start the engine, allowing it to idle and warm up gradually.

59. Turn the engine **OFF**. Readjust the valves.

60. Restart the engine and adjust the timing as necessary.

61. Recheck the fluid levels.

62. Road test the vehicle for general performance and driveability.

3F-E Engine

➧ See Figures 148, 149, 150, 151, 152 and 153

1. Drain the engine coolant.

⁂WARNING

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

2. Disconnect the negative battery cable.
3. Scribe matchmarks around the hood hinges and then remove the hood.
4. Disconnect the accelerator and throttle cables.
5. Remove the hoses and parts as follows:
   - Air intake
   - Air flow meter
   - Air cleaner cap
   - ISC hose
   - Air pump hose
   - Distributor hose
   - PCV hose
   - Remove the 3 hoses from the rear of the intake chamber
   - The 2 hoses from the charcoal canister vacuum valve
6. Unbolt the power steering pump and position it out of the way without disconnecting the hydraulic lines.
7. Unbolt the air conditioning compressor and position it out of the way without disconnecting the refrigerant lines. Use stiff wire or string to support the compressor; do not allow it to hang by the hoses.
8. Remove the power steering pump and air conditioning compressor brackets.
9. Disconnect the high tension cords from the spark plugs and the coil.
10. Disconnect and remove the hoses from the water outlet, water pump, oil cooler and heater water pipe. Unbolt the oil cooler water pipe from the cylinder head.
11. Disconnect the upper radiator hose.
12. Disconnect and plug the fuel lines.
13. Raise the vehicle, making certain it is well supported. Disconnect the exhaust pipe at the manifold.
14. Remove the air pump.
15. Remove the fuel delivery pipe along with the fuel injectors.
16. Remove the air injection manifold.
17. Remove the intake and exhaust manifolds.
18. Disconnect the water bypass hose at the water outlet and then remove the outlet assembly.

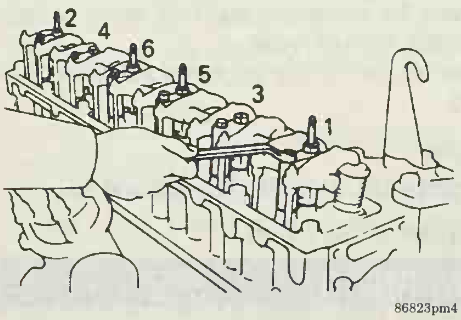

Fig. 148 Loosen the rocker assembly bolts in several passes in this order

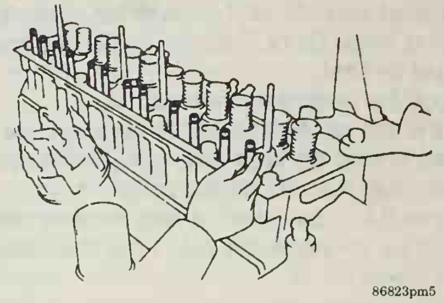

Fig. 149 Remove the pushrods and keep them in order

19. Remove the spark plugs.
20. Disconnect the water bypass hose from the water outlet. Remove the water outlet assembly.
21. Loosen the eight bolts and four nuts that attach the rocker shaft assembly in several stages and in the correct order. Remove the rocker shaft.
22. Remove the twelve pushrods, be sure they are kept in the order in which they were removed; they MUST be installed in the original locations. An upside-down box with holes punched in the bottom will make a good holder; number the holes to correspond with the pushrod position.
23. Loosen the cylinder head bolts in several stages and in the opposite order of the tightening sequence. Remove the air pump bracket and engine hanger.

✲✲CAUTION

Removing the head bolts in the improper order could cause damage to the aluminum cylinder head.

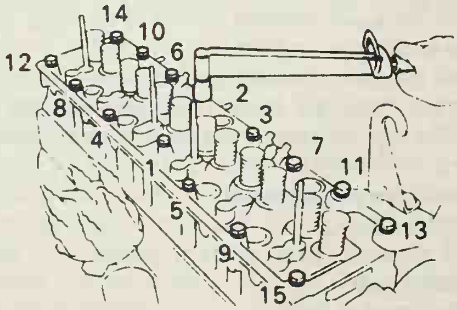

Fig. 150 Tighten the head bolts using this sequence in several passes to prevent head damage

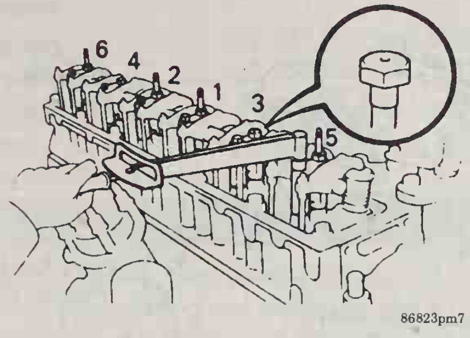

Fig. 151 Tighten the rocker assembly bolts using this order in several passes

24. Lift the cylinder head off of its mounting dowels, Do NOT attempt to slide the head off; it must be lifted. Support the head on a workbench.

To install:

25. Lift the old gasket from the block, then scrape and clean the area well. Insert paper into the cylinder walls to keep dirt from entering.

26. Install the cylinder head on the cylinder block using a new gasket.

27. Lightly coat the threads of the cylinder head bolts with engine oil and then install them into the head. Tighten them in several stages, in the order shown.

28. Install the pushrods in the order that they were removed.

29. Position the rocker shaft assembly on the cylinder head and align the rocker arm adjusting screws with the heads of the pushrods. Tighten the mounting bolts with a 12mm head to 17 ft. lbs. (24 Nm); tighten the bolts with a 14mm head to 25 ft. lbs. (33 Nm).

30. Adjust the valve clearance and install the spark plugs.

31. Install the valve cover and tighten the cap nuts to 78 inch lbs. (9 Nm).

32. Install the water outlet and connect the bypass hose. Tighten the bolts to 18 ft. lbs. (25 Nm).

33. Install the intake and exhaust manifolds using a new gasket. Make sure the front mark on the gasket is towards the front of the engine. Tighten the following:
    - 17mm bolts (A) — 51 ft. lbs. (69 Nm)
    - 14mm bolts (B) — 37 ft. lbs. (50 Nm)
    - Nuts (C) — 41 ft. lbs. (56 Nm)

34. Install the heat insulators and the manifold stay. Tighten the manifold heat shield bolts to 9 ft. lbs. (12 Nm) and the manifold support bolts to 22 ft. lbs. (29 Nm).

35. Install the air injection manifold and tighten the union nuts and clamp bolts to 15 ft. lbs. (21 Nm).

36. Install the fuel injector/delivery pipe assembly.

37. Install the air pump and connect the air hose.

38. Connect the exhaust pipe to the manifold. Use a new gasket and tighten the bolts to 46 ft. lbs. (62 Nm).

39. Connect the fuel lines and the upper radiator hose.

40. Install the oil cooler pipe; connect the hoses to the water outlet, water pump, oil cooler and heater water pipe.

41. Connect the spark plugs and coil wires.

42. Install the air conditioning compressor and the power steering pump. Adjust the belt tension; tighten the power steering pulley nut to 35 ft. lbs. (47 Nm).

43. Install the air intake hose, the air flow meter and the air cleaner cap. Connect the hoses removed during Step 5 of the removal procedure.

44. Connect and adjust the accelerator and throttle cables. Adjust them properly.

45. Refill the engine coolant.

46. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.

47. Connect the negative battery cable.

48. Start the engine, allowing it to idle and warm up gradually.

49. Shut the engine **OFF**. Readjust the valves.

50. Restart the engine and adjust the timing as necessary.

51. Recheck the fluid level.

52. Install the hood.

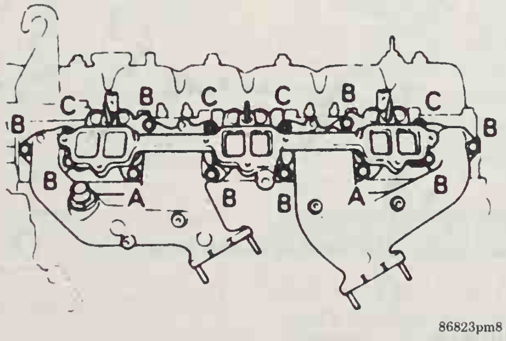

Fig. 152 A, B and C bolt locations

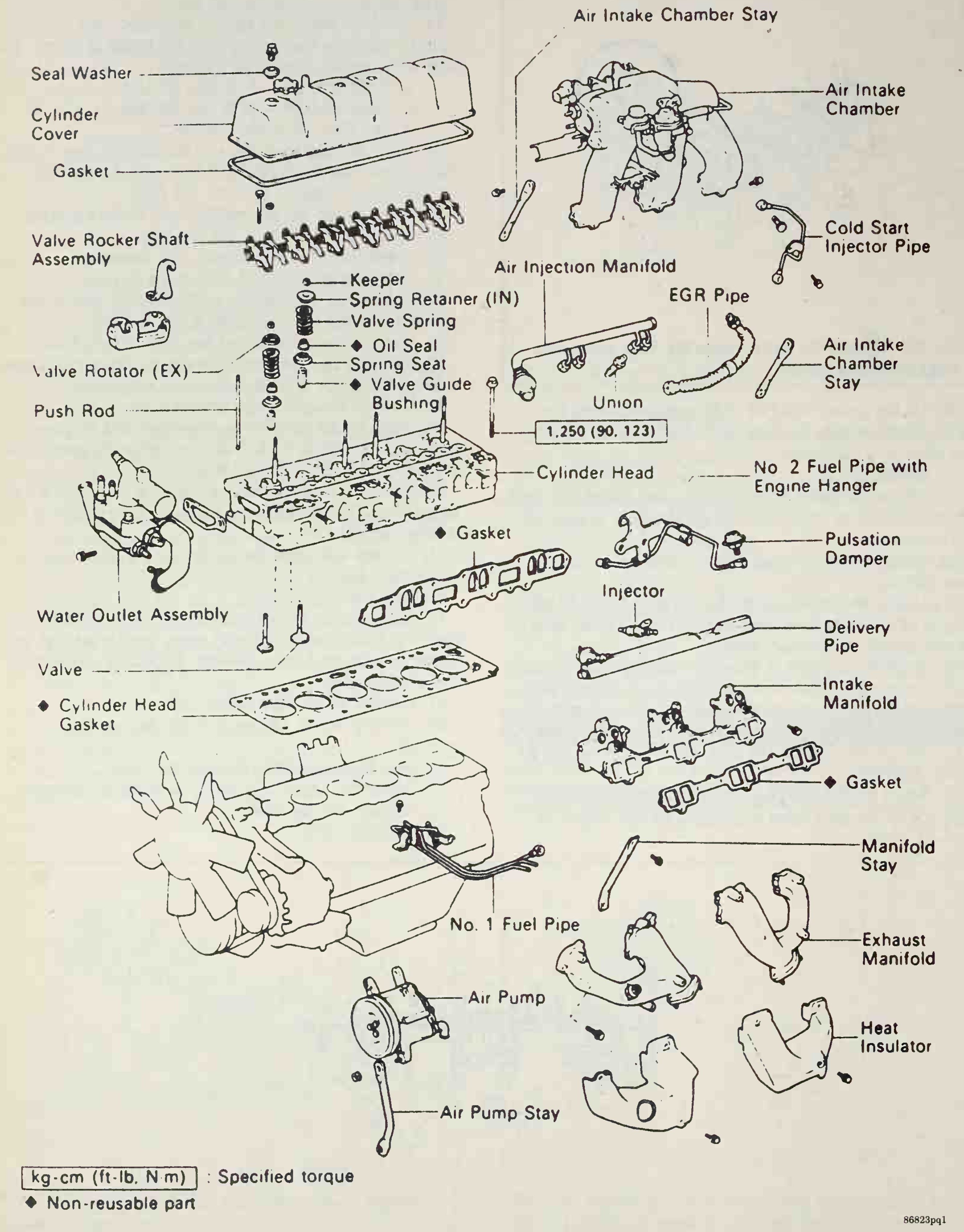
Air Intake Chamber Stay
Seal Washer
Cylinder Cover
Gasket
Air Intake Chamber
Cold Start Injector Pipe
Valve Rocker Shaft Assembly
Air Injection Manifold
Keeper
Spring Retainer (IN)
Valve Spring
◆ Oil Seal
Spring Seat
◆ Valve Guide Bushing
EGR Pipe
Air Intake Chamber Stay
Valve Rotator (EX)
Push Rod
Union
1,250 (90, 123)
Cylinder Head
No. 2 Fuel Pipe with Engine Hanger
◆ Gasket
Pulsation Damper
Injector
Water Outlet Assembly
Delivery Pipe
Valve
Intake Manifold
◆ Cylinder Head Gasket
◆ Gasket
Manifold Stay
No. 1 Fuel Pipe
Exhaust Manifold
Air Pump
Heat Insulator
Air Pump Stay
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86823pq1

Fig. 153 Exploded view of the cylinder head components on the 3F-E engine

53. Road test the vehicle for general performance and driveability.

3VZ-E Engine

➧ See Figures 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170 and 171

1. Disconnect the negative battery cable.
2. Remove the air cleaner hose and case.
3. Drain the engine coolant.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

4. Remove the radiator.
5. Unbolt the power steering pump and position it out of the way with the hoses still attached.
6. Remove the alternator drive belt; remove the fluid coupling and fan pulley.
7. Disconnect the following wires and connectors:
   - Ground strap from left fender apron
   - Alternator connector and wire
   - Igniter connector
   - Oil pressure switch connector
   - Ground strap at rear of engine
   - Electronic Control Unit (ECU) connectors
   - Vacuum Switching Valve (VSV) connectors
   - Starter relay connector (manual trans. only)
   - Solenoid resistor connector
   - The check connector
   - Compressor connector
8. Disconnect the following hoses:
   - Power steering air hoses
   - Brake booster hose
   - Cruise control vacuum hose
   - Charcoal canister hose at the canister
   - Vacuum Switching Valve (VSV) vacuum hose
9. Disconnect the accelerator, throttle and cruise control cables.
10. Disconnect the clutch release (slave) cylinder hose (manual transmission only).
11. Disconnect the two heater hoses and the two fuel lines.
12. Remove the left side scuff plate (inside the left door). Disconnect the oxygen sensor. Disconnect the exhaust pipe at the manifold and at the catalytic converter. Remove the front exhaust pipe.
13. Remove the timing belt. Follow the procedure given later in this section. This is a complicated operation requiring accurate work.
14. Remove the distributor with the spark plug leads attached; position it out of the way.
15. Remove the air intake chamber as follows:
    a. Disconnect the throttle position sensor connector
    b. Disconnect the canister vacuum hose from the throttle body.
    c. Disconnect the vacuum and fuel hoses from the pressure regulator.
    d. Remove the PCV hose from the hose union.
    e. Disconnect the water bypass hose from the intake manifold hose union.
    f. Remove the water bypass hose from the water bypass pipe.
    g. Disconnect the cold start injector connector.
    h. Disconnect the vacuum hose from the fuel filter.
    i. Remove the union bolt and remove the cold start injector tube.
    j. On California vehicles, disconnect the EGR temperature sensor.
    k. Disconnect the EGR vacuum hoses from the air pipe and EGR vacuum modulator.
    l. Remove the intake chamber support. Remove the two water hoses from the EGR valve if so equipped.
    m. Remove the EGR valve with its pipes.
    n. Remove the six bolts and two nuts; remove the intake air chamber.
16. Disconnect the following, then when all are released, remove the two bolts and the engine wire harness:
    - Knock sensor
    - Water temperature sensor
    - Cold start injector time switch connector
    - Water temperature sensor
    - Water temperature sender gauge connector
    - Right ground strap
    - Injector connectors
17. Remove the fuel pipes.
18. Remove the timing belt cover.
19. Remove the idler pulley and the timing belt cover.
20. Remove the right side fuel delivery pipe (fuel rail) with the injectors.
21. Remove the left fuel delivery pipe and the injectors.
22. Disconnect the hose and remove the water bypass outlet.
23. Remove the intake manifold.
24. Remove the knock sensor wire.
25. Remove the exhaust crossover pipe.

Right side:

26. Remove the reed valve with the air injection manifold.
27. Remove the water bypass pipe mounting bolt.
28. Remove the alternator.
29. Remove the right valve cover.
30. Remove the two bolts and camshaft housing rear cover. Loosen each cam bearing cap bolt a little at a time and in the correct order. When all are loose, remove the bolts and remove the camshaft along with the oil seal and housing plug.
31. Remove the 6-point head bolt from the head first.
32. Loosen the cylinder head bolts in several stages, in the correct order.

⁂WARNING

Removing the head bolts in the improper order could cause damage to the cylinder head.

33. Lift the cylinder head off of its mounting dowels; do NOT attempt to slide it off. If the head is difficult to remove, gently pry with a small tool between the head and block projection. Take great care not to damage the mating faces of the block

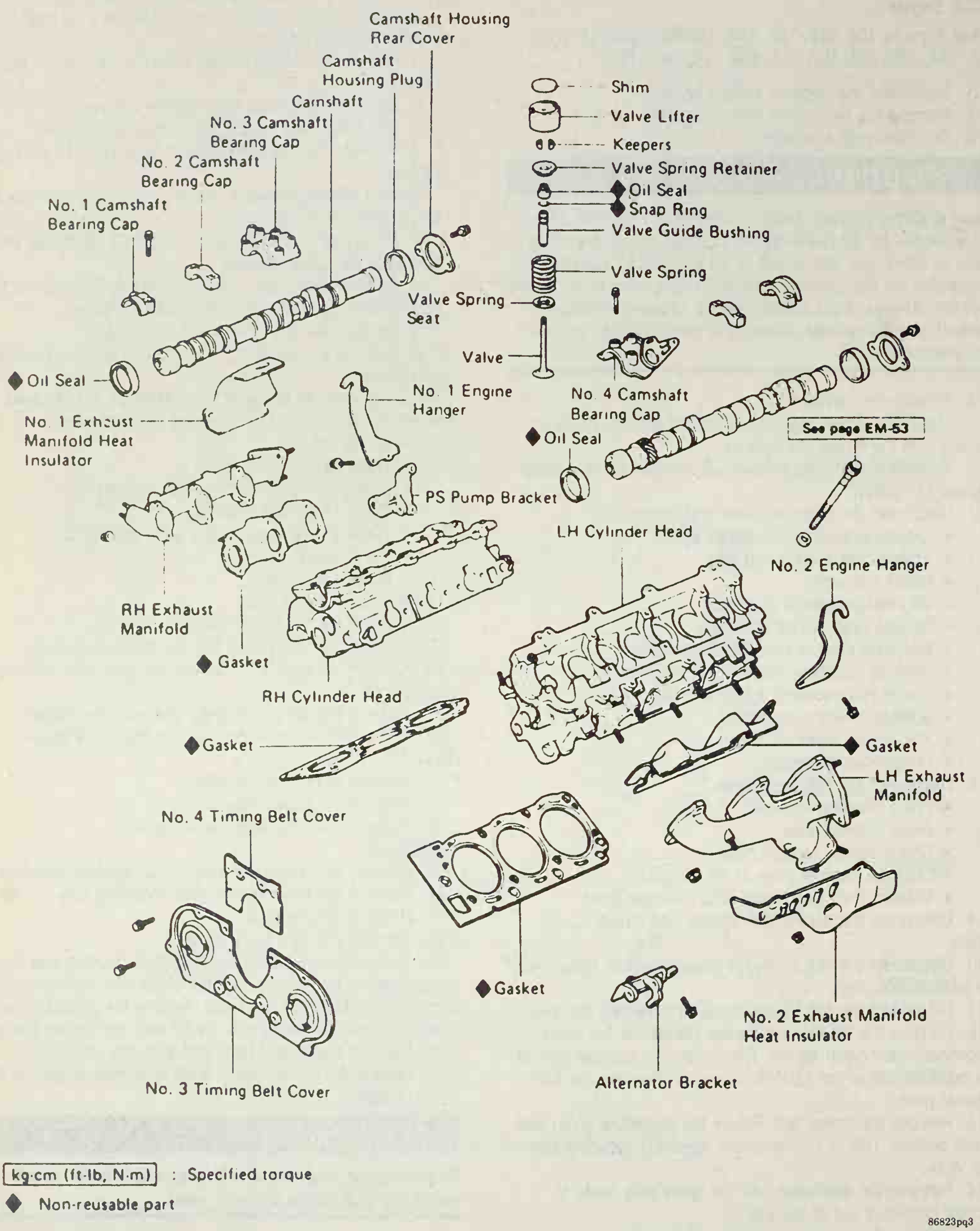
Camshaft Housing Rear Cover
Camshaft Housing Plug
Camshaft
No. 3 Camshaft Bearing Cap
No. 2 Camshaft Bearing Cap
No. 1 Camshaft Bearing Cap
Shim
Valve Lifter
Keepers
Valve Spring Retainer
◆Oil Seal
◆Snap Ring
Valve Guide Bushing
Valve Spring
Valve Spring Seat
Valve
◆Oil Seal
No. 1 Exhaust Manifold Heat Insulator
No. 1 Engine Hanger
No. 4 Camshaft Bearing Cap
◆Oil Seal
See page EM-53
PS Pump Bracket
LH Cylinder Head
No. 2 Engine Hanger
RH Exhaust Manifold
◆Gasket
RH Cylinder Head
◆Gasket
◆Gasket
LH Exhaust Manifold
No. 4 Timing Belt Cover
◆Gasket
No. 2 Exhaust Manifold Heat Insulator
Alternator Bracket
No. 3 Timing Belt Cover
kg·cm (ft·lb, N·m) : Specified torque
◆ Non-reusable part
86823pq3

Fig. 154 Exploded view of the cylinder head — 3VZ-FE engine

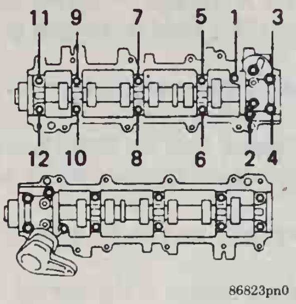
11
9
7
5
1
3
12
10
8
6
2
4
86823pn0

Fig. 155 Release the camshaft retaining bolts in this order — RH shown

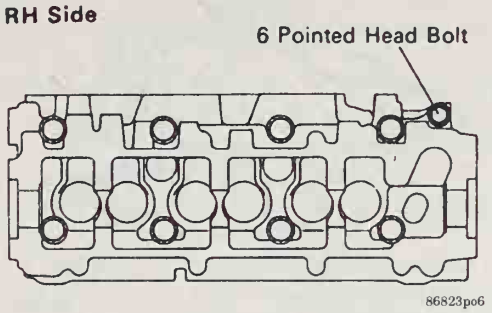
RH Side
6 Pointed Head Bolt
86823po6

Fig. 156 Remove the 6 point head bolt first

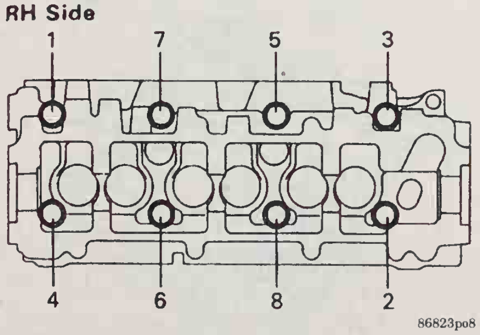
RH Side
1
7
5
3
4
6
8
2
86823po8

Fig. 157 Remove the head bolts using this sequence in several passes

and/or head. Support the head on wooden blocks on the workbench.

34. Remove the exhaust manifold from the cylinder head.

Left side:

35. Remove the alternator.
36. Remove the oil dipstick. Remove the bolt and remove the dipstick guide tube.
37. Remove the left valve cover.
38. Remove the two bolts and camshaft housing rear cover. Loosen each cam bearing cap bolt a little at a time and in the correct order. When all are loose, remove the bolts and remove the camshaft along with the oil seal and housing plug.
39. Remove the 6 point cylinder head bolt.
40. Loosen the cylinder head bolts in several stages, in the correct order.

⁂WARNING

Removing the head bolts in the improper order could cause damage to the cylinder head.

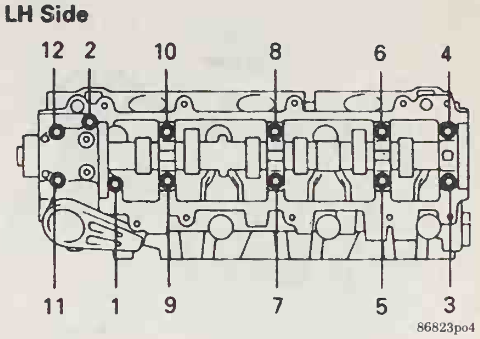
LH Side
12
2
10
8
6
4
11
1
9
7
5
3
86823po4

Fig. 158 Release the camshaft retaining bolts in this order — LH shown

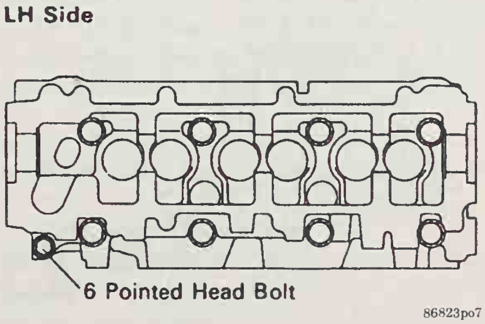
LH Side
6 Pointed Head Bolt
86823po7

Fig. 159 Left side 6 point head bolt location

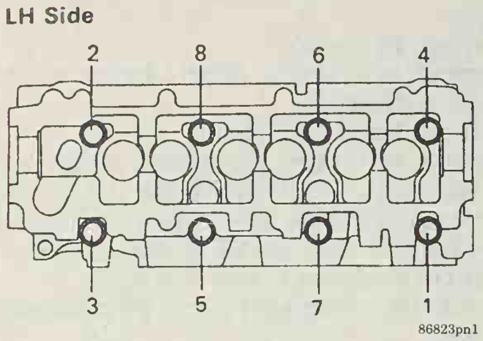

Fig. 160 Remove the head bolts following this pattern in several passes

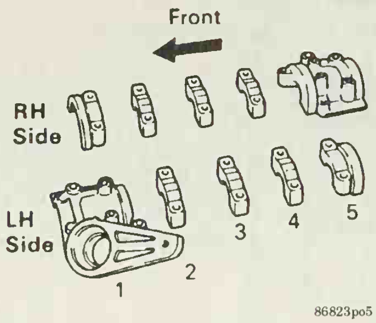

Fig. 161 Arrange the bearing caps in the correct order

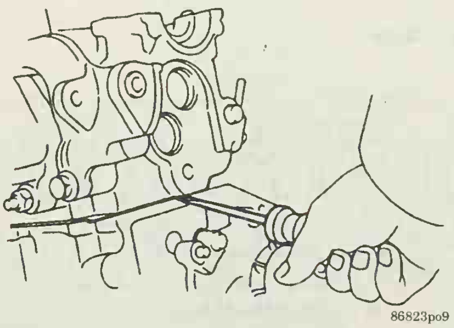

Fig. 162 If the head is difficult to remove, gently pry with a small tool between the head and block projection

41. Lift the cylinder head off of its mounting dowels; do NOT attempt to slide it off. If the head is difficult to remove, gently pry with a small tool between the head and block projection. Take great care not to damage the mating faces of the block and/or head. Support the head on wooden blocks on the workbench.

42. Remove the exhaust manifold from the cylinder head.

To install:

43. Lift the old gasket from the block, then scrape and clean the area well. Insert paper into the cylinder walls to keep dirt from entering.

44. Install the cylinder head on the cylinder block using a new gasket.

45. Lightly coat the threads of the cylinder head bolts with engine oil and then install them into the head. Do not install bolt 6-pointed bolt at this time. Tighten the bolts in several stages, in the order shown to 33 ft. lbs. (44 Nm). After the initial tightening, mark the front side of the top of the bolt with paint. Tighten the bolts an additional 90° (¼ turn) and check that the mark is now facing the side of the head. Tighten the

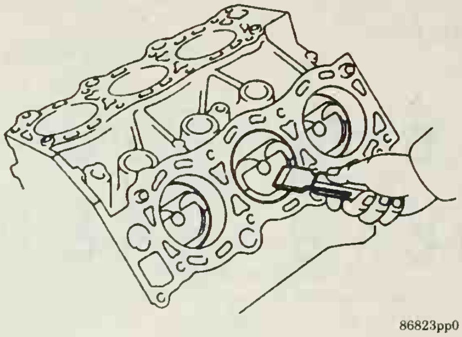

Fig. 163 Carefully clean the top surfaces of the pistons . . .

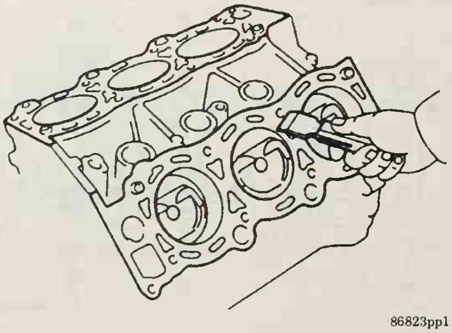

Fig. 164 . . . and the cylinder block

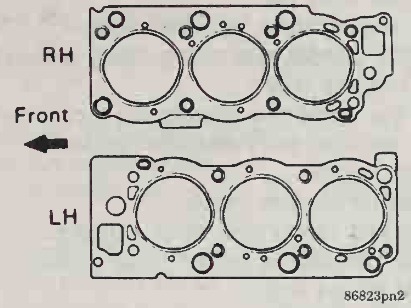

Fig. 165 Position the new gaskets on the cylinder heads as shown

bolts an additional 90° and check that the mark is now facing the rear of the head.

46. Install the 6-pointed head bolts. Tighten to 30 ft. lbs. (41 Nm).

47. Install the camshaft. Install a new oil seal and install the camshaft housing plug.

48. Apply sealant to the Nos. 1 and 5 cam bearing caps. Place the caps on each journal with the arrows correctly aligned. On the right head, they should point to the front; on the left head, to the rear.

49. Temporarily tighten the bearing cap bolts just snug, a little at a time and in the correct order.

50. Use a seal driver of the correct diameter to install the oil seal. Use the same tool to install the camshaft housing plug.

51. Tighten the bearing caps to the correct torque. Make several passes and proceed in the proper order. Correct torque is 12 ft. lbs. (16 Nm).

52. Check the valve clearance. Intake 0.007-0.011 in. (0.18-0.28mm) and exhaust is 0.009-0.013 in. (0.22-0.32mm).

53. Install the valve covers.

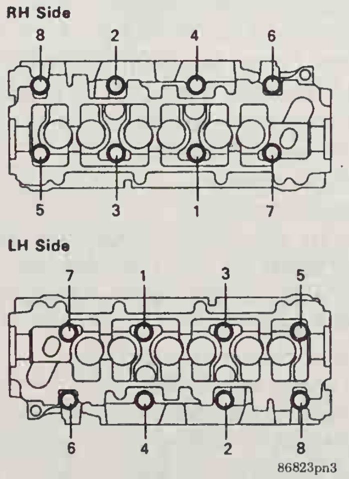

Fig. 166 Tighten the head bolts down in several passes in this order

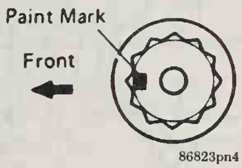

Fig. 167 Mark the head of the bolt with some paint

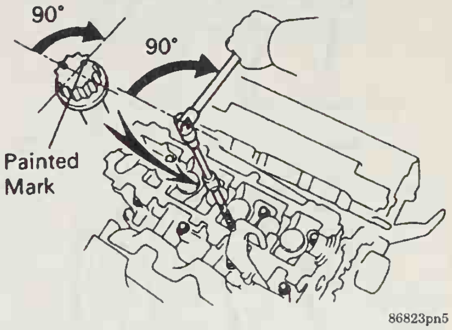

Fig. 168 Turn the bolts exactly 90°

54. Install the alternator and the water bypass pipe mounting bolt.

55. Install the reed valve with the injection manifold. Tighten the bolts to the cylinder head to 27 ft. lbs. (37 Nm); tighten the bolts to the exhaust manifold to 22 ft. lbs. (29 Nm).

56. Repeat installation for the opposite head if it was removed.

57. Install the oil dipstick tube.

58. Install the crossover pipe and tighten it to 29 ft. lbs. (39 Nm).

59. Connect the oxygen sensor wire.

60. Install the intake manifold with new gaskets and tighten the mounting bolts to 13 ft. lbs. (18 Nm).

61. Install the water bypass outlet and tighten the two bolts to 13 ft. lbs. (18 Nm).

62. Install the fuel delivery pipes and injectors. Tighten the bolts to 9 ft. lbs. (13 Nm)

63. Install the idler pulley. Install the timing belt covers and tighten the bolts to 74 inch lbs. (8 Nm).

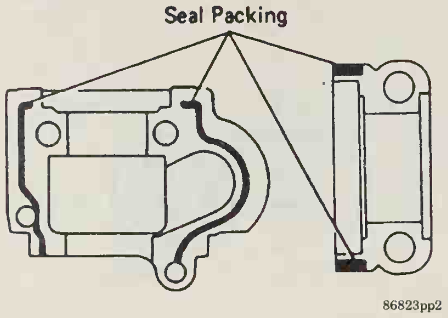

Fig. 169 Apply sealant to the No. 1 and No. 5 bearing caps as shown

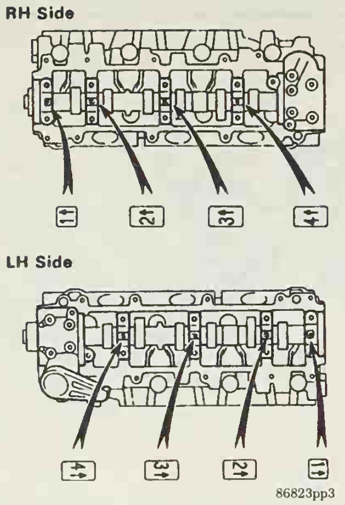

Fig. 170 Position the caps in the correct places

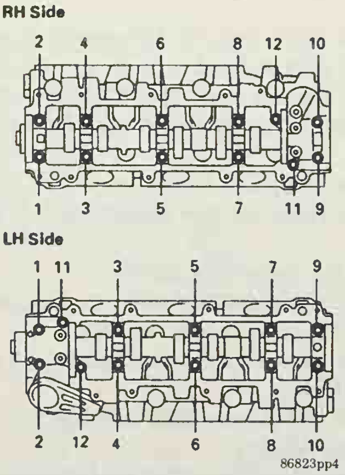

Fig. 171 Bolt tightening sequence for the camshaft bearing caps

64. Install the remaining timing belt cover.
65. Install the fuel pipes and tighten the union bolts to 22 ft. lbs. (29 Nm).
66. Install the timing belt.
67. Check and adjust the valve clearance.
68. Install the cylinder head covers. Apply sealant to the head in the locations shown.
69. Install the engine wire harness and secure the two bolts.
70. Attach the wires and connectors removed:
    - Knock sensor
    - Water temperature sensor
    - Cold start injector time switch connector
    - Water temperature sender gauge connector
    - Right ground strap
    - Injector connectors
71. Install the air intake chamber and tighten the nuts and bolts to 13 ft. lbs. (18 Nm).
72. Install the EGR valve and connect all hoses and lines. Install and tighten the bolts and nuts correctly.
    - A — 9 ft. lbs. (12 Nm)
    - B — 13 ft. lbs. (18 Nm)
    - C — 22 ft. lbs. (29 Nm)
73. Install the distributor and spark plug wires.
74. Install the front exhaust pipe, using new gaskets. Connect the oxygen sensor and replace the left sill plate.
75. Connect the fuel lines and heater hoses.
76. Connect the clutch release (slave) cylinder hose (manual trans. only.)
77. Install the power steering pump.
78. Connect the throttle control cable (auto. trans.), cruise control cable and the accelerator cable.
79. Connect the hoses detached:
    - Power steering air hoses
    - Brake booster hose
    - Cruise control vacuum hose
    - Charcoal canister hose at the canister
    - Vacuum Switching Valve (VSV) vacuum hose
80. Attach the wires and connectors detached:
    - Ground strap from left fender apron
    - Alternator connector and wire
    - Igniter connector
    - Oil pressure switch connector
    - Ground strap at rear of engine
    - Electronic Control Unit (ECU) connectors
    - Vacuum Switching Valve (VSV) connectors
    - Starter relay connector (manual trans. only)
    - Solenoid resistor connector
    - The check connector
    - Compressor connector
81. Install the fan pulley, fluid coupling and drive belts.
82. Install and adjust the air conditioning belt.
83. Install the power steering belt and adjust it.
84. Install the radiator.
85. Install the air cleaner case and hose.
86. Refill the engine with coolant.
87. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the engine area.
88. Connect the battery cable. Start the engine, allowing it to warm up at idle. Check carefully for leaks.
89. Check and adjust engine specifications as necessary.

90. Road test the vehicle for general performance and driveability.
91. Check and adjust fluid levels.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 172, 173, 174, 175, 176, 177, 178, 179 and 180

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Remove the air cleaner cap, MAF meter, and the resonator.
4. If equipped with a manual transaxle, disconnect the accelerator cable from the throttle body.
5. If equipped with a automatic transaxle, disconnect the accelerator and throttle cables from the throttle body.
6. Remove the intake air connector:
    - Air hose for the IAC
    - Vacuum sensing hose
    - Wire clamp for the engine
7. Remove the oil dipstick guide.
8. If equipped with A/C, remove the air conditioning idle-up valve.
9. Remove the power steering drive belt.
10. Remove the idler pulley by removing the three bolts.
11. Remove the power steering drive belt, pump and bracket.
12. Remove the PCV hoses.
13. Remove the distributor connector, hold-down bolts, and the distributor.
14. Remove the water housing as follows:
    a. Disconnect the radiator inlet hose.
    b. Disconnect the ECT sender gauge connector.
    c. Remove the two bolts, water housing, and the gasket.
15. Remove the throttle body.
16. Disconnect the following harnesses:
    - If equipped with A/C, the A/C compressor wiring
    - Oil pressure sensor
    - ECT sensor
    - EGR gas temperature sensor
    - EGR Vacuum Switching Valve (VSV)
17. Disconnect the engine wire as follows:
    a. Remove the two bolts and disconnect the engine wire from the intake chamber.
    b. Disconnect the five engine wire clamps and engine wire.
    c. Detach the following connectors:
        - Knock sensor
        - Crankshaft position sensor
        - Fuel pressure control VSV
    d. Disconnect the DLC1 from the bracket.
    e. Disconnect the two engine wire clamps.
    f. Remove the bolt, then disconnect the engine wire from the engine.
18. Disconnect the fuel injectors.
19. Remove the cylinder head rear cover by disconnecting the heater bypass hose, then remove the three bolts.
20. Remove the EGR valve and vacuum modulator.
21. Remove the intake chamber stay by removing the two bolts.

⁂CAUTION

Fuel injection systems remain under pressure after the engine has been turned OFF. Properly relieve fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

22. Unbolt the fuel return pipe and separate from the hoses.
23. Remove the intake chamber as follows:
    a. Disconnect the vacuum hose from the gas filter.
    b. Disconnect the brake booster vacuum hose from the intake chamber.
    c. Remove the three bolts, two nuts, air intake chamber, and the gasket.
24. Remove the fuel inlet tube by removing the union bolts.
25. Remove the delivery pipe and injectors.

➡Be careful not to drop the injectors when removing the delivery pipe.

26. Remove the intake manifold by removing the three bolts and two nuts.
27. Disconnect the front exhaust pipe from the exhaust manifold.
28. Remove the heat insulator by loosening the two bolts and two nuts.
29. Remove the exhaust manifold and gasket.
30. Remove the engine hangers.
31. Remove the valve cover and gasket.
32. Remove the spark plug wires and plugs from the engine.
33. Set No. 1 cylinder to TDC compression stroke. The groove on the crankshaft pulley should align with the **0** mark on the timing chain cover and the timing marks (one and two dots) of the camshaft gears should form a straight line in respect to the cylinder head surface. If not, turn the crankshaft 1 revolution (360 degrees).
34. Remove the chain tensioner and gasket by removing the two nuts.

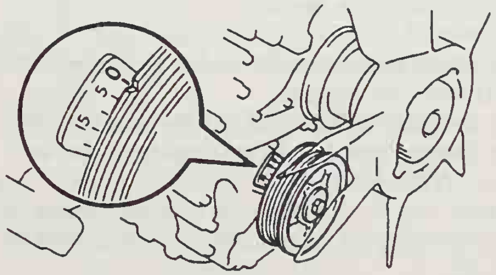

Fig. 172 Set No. 1 cylinder to TDC compression stroke

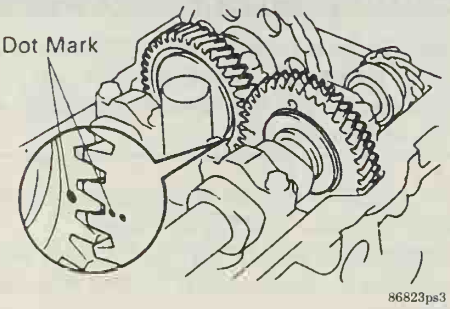

Fig. 173 Check that the marks on the gears are properly aligned

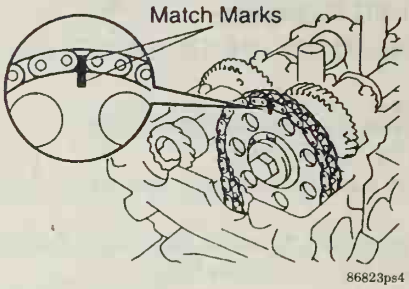

Fig. 174 Matchmark the position of the chain on the gear

35. Remove the camshaft timing gear.

➡Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break.

36. Remove exhaust camshaft.

⁂WARNING

When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

37. Remove the intake camshaft.

➡Do not pry on or attempt to force the camshaft with a tool or other object.

38. Remove the 2 bolts in the front of the head before the other head bolts are removed. Uniformly loosen and remove the remaining head bolts, in several passes, in the sequence shown.

39. Lift the cylinder head from the block and place the head on wooden blocks on a bench.

To install:

40. Before installing, thoroughly clean the gasket mating surfaces and check for warpage.

41. Apply sealant (08826-00080 or equivalent) to the 2 locations, as shown. Place a new head gasket on the block and install the cylinder head.

42. Lightly coat the cylinder head bolts with engine oil. Install the bolts and tighten in several passes in the sequence shown:

a. Tighten all bolts to 29 ft. lbs. (39 Nm).

b. Mark the front of the bolt with paint and retighten bolts 90 degrees in the proper sequence.

c. Retighten an additional 90 degrees. Check that the painted mark is now facing rearward.

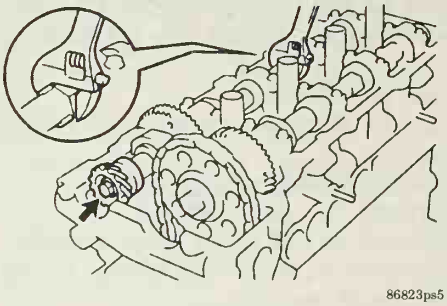

Fig. 175 Hold the hexagon head portion of the camshaft with a wrench and remove the bolt securing the gear

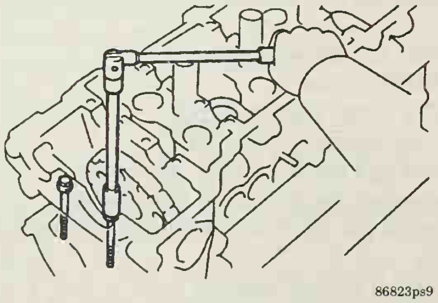

Fig. 176 Remove the 2 bolts at the front of the head first

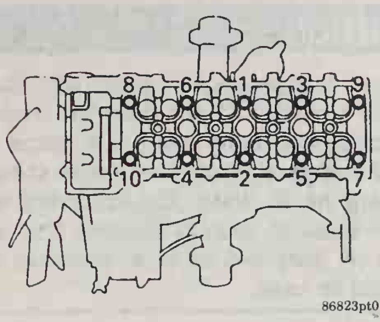

Fig. 177 Remove the cylinder head bolts using this order, in several passes

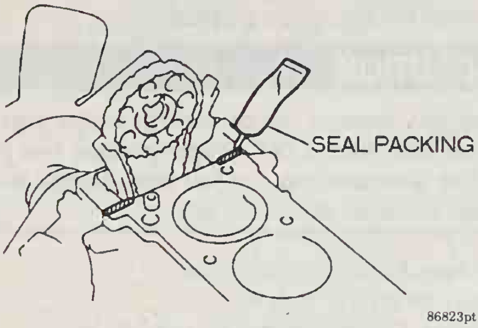

Fig. 178 Apply sealant to the head in these areas

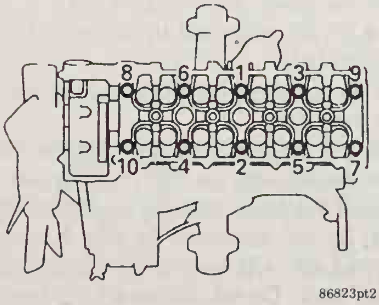

Fig. 179 Tighten the head bolts down uniformly using this sequence in several passes

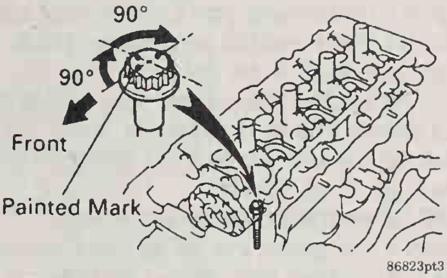

Fig. 180 Mark the front of the bolt with paint and retighten bolts 90 degrees in the proper sequence

43. Install and tighten the 2 front mounting bolts to 15 ft. lbs.(21 Nm).

➡If any of the bolts break, deform or do not meet the torque specification, replace them.

44. Install the intake camshaft.
45. Install the exhaust camshaft.
46. Set No. 1 cylinder to TDC compression stroke: the crankshaft pulley groove will align with the **0** mark on timing cover and camshafts timing marks with one dot and two dots will be in a straight line on the cylinder head surface.
47. Install the timing gear. Place the gear over the straight pin of the intake camshaft.
    a. Hold the intake camshaft with a wrench. Install and tighten the bolt to 54 ft. lbs. (74 Nm).
    b. Hold the exhaust camshaft and install the bolt and distributor gear. Tighten the bolt to 34 ft. lbs. (46 Nm).
48. Install the chain tensioner, using a new gasket (mark toward the front) as follows:
    a. Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.
    b. Turn the crankshaft pulley clockwise to provide some slack for the chain on the tensioner side.
    c. Push the tensioner by hand until it touches the head installation surface, then install the 2 nuts. Tighten the nuts to 13 ft. lbs. (18 Nm). Check that the hook of the tensioner is not released.
    d. Turn the crankshaft to the left so that the hook of the chain tensioner is released from the pin of the plunger, allowing the plunger to spring out and the slipper to be pushed into the chain.
49. Check and adjust the valve clearance. Intake valve clearance is 0.006-0.010 inch (0.15-0.25 mm) and exhaust valve clearance is 0.010-0.014 inch (0.25-0.35 mm).
50. Recheck the engine for proper valve timing. Check and adjust the valve clearance.
51. Install the spark plugs and the semi-circular plug.
52. Recheck the engine for proper valve timing. Install the valve cover and engine hangers. Tighten the engine hanger bolts to 30 ft. lbs. (42 Nm).

53. Install the exhaust manifold and gasket to the engine and install the six nuts. Tighten the nuts to 36 ft. lbs. (49 Nm).
54. Install the heat insulator with the two bolts and two nuts. Tighten the bolts and nuts to 48 inch lbs. (6 Nm).
55. Install the front exhaust pipe to the exhaust manifold.
56. Install the intake manifold using a new gasket. Tighten the bolts and nuts to 22 ft. lbs. (29 Nm).
57. Install the injectors and delivery pipe. Tighten the bolts holding the delivery pipe to 15 ft. lbs. (21 Nm).
58. Install the fuel tube with four new gaskets. Tighten the union bolts to 22 ft. lbs. (29 Nm).
59. Install the air intake chamber as follows:
    a. Install a new gasket and the air intake chamber with the three bolts and two nuts. Tighten the bolts and nuts to 15 ft. lbs. (21 Nm).
    b. Connect the vacuum hose to the gas filter.
    c. Connect the brake booster vacuum hose to the intake chamber.
60. Install the fuel return pipe by installing the two bolts and hoses.
61. Install the intake chamber stay by installing the two bolts. Tighten the bolts to 14 ft. lbs. (20 Nm).
62. Install the EGR valve and vacuum modulator.
63. Install the cylinder head rear cover with a new gasket. Tighten the three bolts to 10 ft. lbs. (14 Nm).
64. Connect the heater water bypass pipe.
65. Connect the injector wiring.
66. Connect the engine wire to the engine as follows:
    a. Secure the engine wire to the intake manifold.
    b. Connect the two engine wire clamps.
    c. Attach the DLC1 to the bracket.
    d. Attach the following connectors:
        - Fuel pressure control VSV connector
        - Knock sensor connector
        - Crankshaft position sensor connector
    e. Connect the five engine wire clamps.
    f. Connect the engine wire to the intake chamber with the two bolts.
67. Attach the following connections to the engine:
    - EGR — Vacuum Switching Valve (VSV)
    - EGR gas temperature sensor
    - ECT sensor
    - Oil pressure sensor
    - With A/C, connect the compressor
68. Install the throttle body.
69. Install the water outlet with a new gasket. Install the two bolts and tighten the bolts to 14 ft. lbs. (20 Nm). Connect the ECT sender gauge connector and radiator inlet hose.
70. Install the distributor.
71. Install the 2 PCV hoses.
72. Install the power steering pump bracket by installing the four bolts, tighten to 14 ft. lbs. (20 Nm).
73. Install the power steering pump to the bracket.
74. Install the idler pulley with the three bolts, tighten to 14 ft. lbs. (20 Nm).
75. With A/C, install the A/C idle up valve.
76. Install the air intake connector by installing the two bolts, hose clamp, and two air hoses.
77. If equipped with a manual transaxle, connect the accelerator cable to the throttle body.
78. If equipped with a automatic transaxle, connect the throttle and accelerator cables to the throttle body.
79. Install the MAF meter, resonator, and the air cleaner cap.
80. Refill the cooling system. Drain and refill the engine oil.

✲✲CAUTION

The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer! You should make every effort to minimize you exposure to used engine oil. Protective gloves should be worn when changing the oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.

81. Connect the negative battery cable. Start the engine and check for leaks.
82. Check the ignition timing. Road test the vehicle for proper operation.
83. Recheck and top off all fluid levels.

5VZ-FE Engine

➧ See Figures 181, 182 and 183

1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure.

✲✲CAUTION

Fuel injection systems remain under pressure after the engine has been turned OFF. Properly relieve fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

3. Remove the engine under cover.
4. Drain the cooling system.
5. Remove the front exhaust pipe as follows.
6. Disconnect the air cleaner cap, MAF meter and the resonator.
7. Disconnect the following cables:
    - If equipped with cruise control, disconnect the actuator cable with the bracket
    - Accelerator cable
    - With A/T, Throttle cable
8. Disconnect the heater hose.
9. Disconnect the upper radiator hose from the engine.
10. Remove the power steering drive belt.
11. Remove the A/C drive belt by loosening the idle pulley nut and adjusting bolt.
12. Loosen the lock bolt, pivot bolt and adjusting bolt and the alternator drive belt.
13. Remove the fan shroud by removing the two clips.
14. Remove the fan with the fluid coupling and fan pulleys.
15. Disconnect the power steering pump from the engine and set aside. Do not disconnect the lines from the pump.
16. If equipped with A/C, remove the compressor from the engine and set aside. Do not disconnect the lines from the compressor.
17. If equipped with A/C, remove the A/C bracket.
18. Remove the spark plug wires with the ignition coils.
19. Remove the spark plugs.
20. Remove the timing belt cover.
21. Remove the fan bracket.

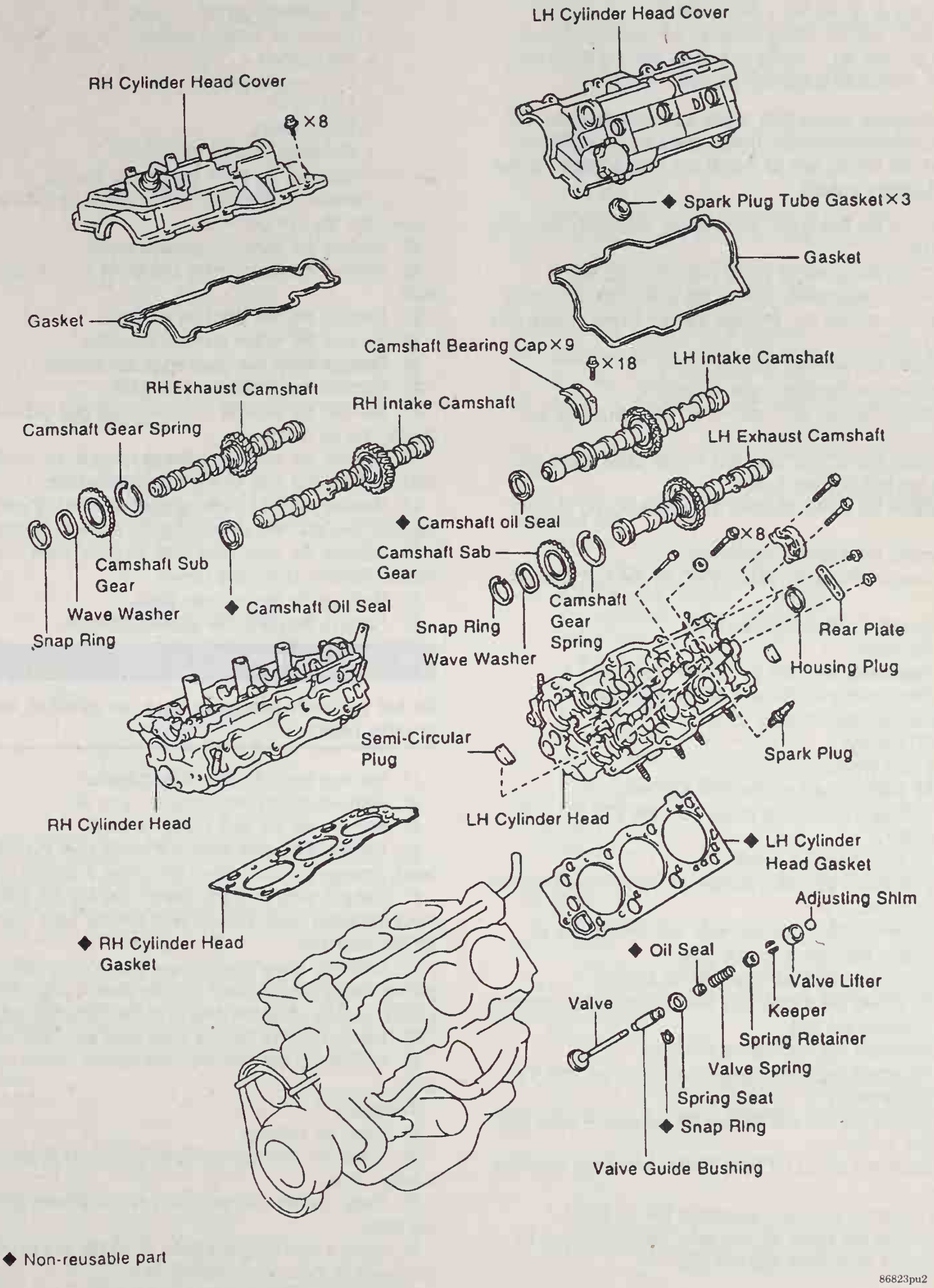
LH Cylinder Head Cover
RH Cylinder Head Cover
×8
◆ Spark Plug Tube Gasket×3
Gasket
Gasket
Camshaft Bearing Cap×9
×18
LH Intake Camshaft
RH Exhaust Camshaft
RH Intake Camshaft
Camshaft Gear Spring
LH Exhaust Camshaft
◆ Camshaft oil Seal
×8
Camshaft Sab Gear
Camshaft Sub Gear
Wave Washer
◆ Camshaft Oil Seal
Snap Ring
Snap Ring
Camshaft Gear Spring
Wave Washer
Rear Plate
Housing Plug
Semi-Circular Plug
Spark Plug
RH Cylinder Head
LH Cylinder Head
◆ LH Cylinder Head Gasket
Adjusting Shim
◆ RH Cylinder Head Gasket
◆ Oil Seal
Valve Lifter
Valve
Keeper
Spring Retainer
Valve Spring
Spring Seat
◆ Snap Ring
Valve Guide Bushing
◆ Non-reusable part
86823pu2

Fig. 181 Exploded view of the cylinder head

22. Set the No. 1 cylinder at TDC of the compression stroke.

a. Turn the crankshaft pulley and align its groove with the timing mark **O** of the No. 1 timing belt cover.

b. Check that the timing marks of the camshaft timing pulleys and the No. 3 timing belt cover are aligned. If not, turn the crankshaft pulley one revolution (360°).

➡If re-using the timing belt, make sure that you can still read the installation marks. If not, place new installation marks on the timing belt to match the timing marks of the camshaft timing pulleys.

23. Remove the timing belt tensioner by alternately loosening the two bolts.
24. Remove the camshaft timing pulleys. Using SST 09960-10010 or equivalent, remove the pulley bolt, the timing pulley and the straight pin. Remove the two timing pulleys with the timing belt.
25. Remove the bolt and the idler pulley.
26. Remove the alternator from the engine.
27. Remove the nuts and remove the EGR pipe and two gaskets.
28. Remove the oil filler tube and throttle cable clamp by removing the bolt and two nuts.
29. Remove the intake chamber stay by removing the two bolts.
30. Remove the following connectors:
    - Vacuum Switching Valve (VSV) for the fuel pressure control
    - Throttle Position Sensor (TPS)
    - IAC valve
    - Disconnect the EGR gas temperature wire
    - Disconnect the VSV wire for the EGR valve
31. Disconnect the following hoses:
    - PCV hoses
    - Water bypass
    - Air assist hose from the intake air wire
    - Two vacuum sensing hoses from the VSV
    - EVAP
    - Air hose from the power steering
    - If equipped with A/C, disconnect the air hose from the A/C idle up valve.
32. Remove the four bolts, two nuts and remove the air intake chamber assembly from the engine.
33. Remove the intake air connector as follows:

a. Disconnect the engine wire from the intake air connector by removing the bolt.

b. Disconnect the two fuel return hoses.

c. Disconnect the brake booster vacuum hose from the intake air connector.

d. Remove the bolt and disconnect the ground strap from the intake air harness.

e. Disconnect the DLC1 from the bracket of the intake air harness.

f. If equipped with A/C, disconnect idle up valve.

g. Remove the intake air connector from the engine by removing the three bolts and two nuts.

34. Disconnect the engine wire from the intake manifold as follows:

a. Disconnect the following wiring:
- Oil pressure sensor
- Crankshaft position sensor
- Six injectors
- ECT sender gauge
- ECT sensor
- Knock sensor
- Camshaft position sensor

b. Disconnect the three engine wire clamps.

c. Remove the three bolts, then disconnect the engine wire from the cylinder head.

35. Remove the camshaft position sensor.
36. Remove the (rear) timing belt cover by removing the six bolts.
37. Remove the fuel pressure regulator.
38. Remove the intake manifold assembly.
39. Remove the power steering pump bracket.
40. Remove the oil dipstick and guide.
41. Remove the exhaust crossover pipe and gaskets by removing the six nuts.
42. Remove the left hand exhaust manifold by unbolting the heat insulator and nuts for the exhaust manifold.
43. Remove the right hand exhaust manifold by unbolting the heat insulator and six nuts for the exhaust manifold.
44. Remove the eight bolts, seal washers, valve cover and gasket. Remove both valve covers.
45. Remove the semi-circular plugs.
46. Remove the right side exhaust camshaft.

⁂WARNING

Do not pry on or attempt to force the camshaft with a tool or other object.

47. Remove the right side intake camshaft.
48. Remove the left side exhaust camshaft.
49. Remove the left side intake camshaft.
50. Remove the valve lifters and shims from the cylinder head. Arrange the valve lifters and shims in correct order.
51. Using a 8mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side.
52. Uniformly loosen and remove the eight cylinder head (12 pointed head) bolts on each cylinder head. Loosen the bolts in several passes using the reverse of the tightening sequence.
53. Remove the 16 cylinder head bolts and plate washers.
54. Lift the cylinder head from the dowels on the cylinder block.

To install:

55. Clean all surfaces.
56. Place two new cylinder head gaskets in position on the cylinder block.
57. Place the two cylinder heads on the dowels of the cylinder block.
58. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
59. Install and uniformly tighten the cylinder head bolts on each cylinder as follows:

a. In several passes and in the sequence shown, tighten the cylinder bolts to 25 ft. lbs. (34 Nm).

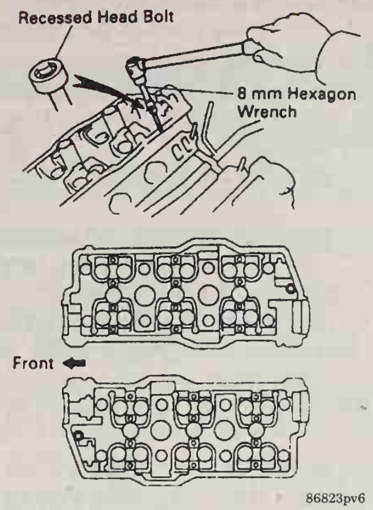

Fig. 182 The recessed bolts must be removed first

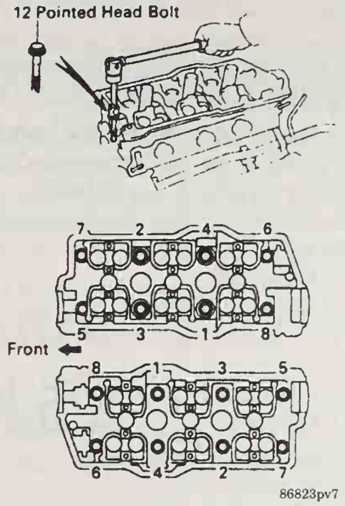

Fig. 183 Cylinder head bolt tightening sequence

b. Mark the front of the cylinder head bolt with paint.

c. Retighten the cylinder head bolts by 90° in order.

d. Check that the painted mark is now at a 90° angle to the front.

60. Apply a light coat of engine oil on the threads and under the heads of the recessed cylinder head bolts. Using a 8mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side. Tighten the bolts to 13 ft. lbs. (18 Nm).

61. Install the valve lifters and shims. Check that the valve lifter rotates smoothly by hand.

62. Install the right intake camshaft.

63. Install the right exhaust camshaft.

64. Install the left intake camshaft.

65. Install the left exhaust camshaft.

66. Check and adjust the valve clearance.

67. Install the semi circular plugs.

68. Install the cylinder head covers. Uniformly tighten the bolts in several passes to 53 inch lbs. (6 Nm).

69. Attach the exhaust manifolds with new gaskets, tighten the nuts to 30 ft. lbs. (40 Nm).

70. Install the exhaust manifold heat insulators with the nuts, tighten to 71 inch lbs. (8 Nm).

71. Install the exhaust crossover pipe and tighten the nuts to 33 ft. lbs. (45 Nm).

72. Install the alternator bracket and tighten to 14 ft. lbs. (18 Nm).

73. Install the oil dipstick and guide using a new O-ring.

74. Install the power steering bracket and tighten to 14 ft. lbs. (18 Nm).

75. Install two new gaskets and the intake manifold assembly. Install the four plate washers, eight bolts and four nuts. Tighten the bolts and nuts to 13 ft. lbs. (18 Nm).

76. Install the intake manifold stay with the two bolts. Tighten the bolts to 14 ft. lbs. (18 Nm).

77. Connect the fuel inlet hose.

78. Install the fuel pressure regulator.

79. Install the timing belt cover with the six bolts. Tighten the bolts to 80 inch lbs. (9 Nm).

80. Install the camshaft position sensor, tighten to 71 inch lbs. (8 Nm).

81. Connect the engine wire to the intake manifold as follows:

a. Install the engine wire to the cylinder head by installing the three bolts.

b. Connect the three engine wire clamps.

c. Attach the following connectors:

- Oil pressure sensor
- Crankshaft position sensor
- Six injectors
- ECT sender gauge
- ECT sensor
- Knock sensor
- Camshaft position sensor

82. Install the intake air connector as follows:

a. Install the intake manifold to the engine by installing the three bolts and two nuts. Tighten the bolts and nuts to 14 ft. lbs. (19 Nm).

b. Attach the DLC1 to the bracket on the intake manifold.

c. Attach the ground strap to the intake manifold by installing the bolt.

d. Connect the brake booster vacuum hose to the intake air connector.

e. Connect the two fuel return hoses.

f. Connect the engine wire to the intake manifold by installing the bolt.

g. If equipped with A/C, connect the idle up valve connector.

83. Install the air intake chamber assembly to the engine by installing the four bolts and two nuts. Tighten the bolts and nuts to 14 ft. lbs. (19 Nm).

84. Connect the following hoses:

- PCV
- Water bypass
- Air assist hose to the intake manifold
- Two vacuum sensing hoses to the VSV
- EVAP hose
- Air hose to the power steering
- If equipped with A/C, connect the air hose to the A/C idle up valve.

85. Attach the following connectors:
   - VSV for the fuel pressure control
   - Throttle position sensor
   - Idle Air Control (IAC) Valve
   - Connect the EGR gas temperature sensor
   - Connect the VSV wire for the EGR valve

86. Install the intake chamber stay. Tighten to 30 ft. lbs. (40 Nm)

87. Install a new O-ring to the oil filler tube. Push in the oil filler tube end into the tube hole in the oil pan. Install the oil filler tube and throttle cable clamp and install the bolt and two nuts.

88. Install two new gaskets and the EGR pipe with the nuts. Tighten the clamp nuts to 71 inch lbs. (8 Nm) and the EGR pipe nuts to 14 ft. lbs. (18 Nm).

89. Install the alternator but do not tighten the bolts and nuts at this time.

90. Install the timing belt idler with the bolt, tighten to 30 ft. lbs. (40 Nm). Check that the pulley bracket moves smoothly.

91. Install the left camshaft timing pulley as follows:
   a. Install the knock pin to the camshaft.
   b. Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley.
   c. Slide the timing pulley on the camshaft with the flange side facing outward. Tighten the pulley bolt to 81 ft. lbs. (110 Nm).

92. Set the No. 1 cylinder to TDC of the compression stroke.
   a. Turn the crankshaft pulley, and align its groove with the timing mark **O** of the timing belt cover.
   b. Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the timing belt cover.
   c. Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and the timing belt cover.

93. Connect the timing belt to the left camshaft timing pulley. Check that the installation mark on the timing belt is aligned with the end of the timing belt cover.
   a. Using SST 09960-01000 or equivalent, slightly turn the left camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the left camshaft timing pulley.
   b. Align the timing marks of the left camshaft pulley and the timing belt cover.
   c. Check that the timing belt has tension between the crankshaft timing pulley and the left camshaft timing pulley.

94. Install the right camshaft timing pulley and the timing belt as follows:
   a. Align the installation mark on the timing belt with the timing mark of the right camshaft timing pulley, and hang the timing belt on the right camshaft timing pulley with the flange side facing inward.
   b. Slide the right camshaft timing pulley on the camshaft. Align the timing marks on the right camshaft timing pulley and the timing belt cover.
   c. Align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin. Install the bolt and tighten to 81 ft. lbs. (110 Nm).

95. Set the timing belt tensioner as follows:
   a. Using a press, slowly press in the pushrod using 220-2,205 lbs. (981-9,807 N) of force.
   b. Align the holes of the pushrod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the pushrod.
   c. Release the press and install the dust boot to the tensioner.

96. Install the timing belt tensioner and alternately tighten the bolts to 20 ft. lbs. (28 Nm). Using pliers, remove the 1.5 mm hexagon wrench from the belt tensioner.

97. Slowly turn the crankshaft pulley two revolutions from the TDC to TDC. Always turn the crankshaft pulley clockwise. Check that each pulley aligns with the timing marks. If the timing marks do not align, remove the timing belt and reinstall it.

98. Install the fan bracket with the bolt and nut.

99. Install the power steering adjusting strut with the nut.

100. Install the timing belt cover, tighten the bolts to 80 inch lbs. (9 Nm).

101. Connect the three clamps for the spark plug wires to the timing belt cover.

102. Connect the camshaft position sensor connector to the timing belt cover.

103. Install the spark plugs.

104. Install the spark plug wires with the ignition coils.

105. If equipped, install the A/C compressor bracket.

106. If equipped, install the A/C compressor.

107. Install the fan with the fluid coupling and fan pulleys, tighten the nuts to 48 inch lbs. (5 Nm).

108. Install the fan shroud.

109. Install the alternator drive belt.

110. Install the cooling fan, then tighten the nuts to 4 ft. lbs. (5 Nm).

111. If equipped, install and adjust the A/C drive belt.

112. Install the PS pump, pump pulley and the drive belt.

113. Connect the upper radiator hose.

114. Connect the heater hose.

115. Connect the following cables:
   - On cruise control, attach the actuator cable with bracket
   - Accelerator cable
   - With A/T, the throttle cable

116. Install the MAF meter, resonator and air cleaner cap.

117. Install the front exhaust pipe.

118. Fill the radiator with engine coolant.

119. Add oil to the engine if needed.

120. Connect the negative battery cable.

121. Start the engine and check for leaks.

122. Check the ignition timing.

123. Install the engine under cover.

124. Road test the vehicle.

125. Recheck and top off all fluid levels.

1FZ-FE Engine

➧ See Figures 184, 185, 186, 187, 188, 189 and 190

1. Release the fuel system pressure.

2. Disconnect the battery cables and remove the battery and the battery tray.

⁂CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

3. Drain the engine coolant.
4. Remove the air cleaner hose and cap.
5. Disconnect the cruise control actuator cable from the throttle body.
6. Disconnect the accelerator cable from the throttle body.
7. Disconnect the throttle cable from the throttle body.
8. Disconnect the engine ground strap from the engine hanger and the ground strap from the air intake chamber.
9. Unplug the connector on the intake manifold from the left fender apron.
10. Disconnect the brake booster vacuum hose.
11. Disconnect the EVAP hose and disconnect the fuel return hose.

⁂CAUTION

Fuel injection systems remain under pressure after the engine has been turned *OFF*. Properly relieve fuel pressure before disconnecting any fuel lines. Failure to do so may result in fire or personal injury.

12. Disconnect the heater hoses.
13. Disconnect the engine wire and heater valve from the cowl panel.
14. Remove the cylinder head covers
15. Remove the distributor.
16. Disconnect the P/S reservoir tank.
17. Disconnect the radiator inlet hose and the water bypass hose.
18. Remove the alternator.
19. Remove the throttle body.
20. Remove the oil dipsticks and guides for the engine and transmission.
21. Remove the intake manifold stay.
22. Disconnect the fuel inlet hose from the fuel filter.
23. Unplug the following connectors:
    a. ECT sender gauge connector, the ECT cut switch connector, and the ECT sensor connector
    b. Knock sensor connector
    c. Crankshaft position sensor connector
24. Remove the bolt and disconnect the engine wire harness from the cylinder block.
25. Disconnect the following:
    a. Oil level sensor connector
    b. Two connectors from the transmission
    c. Starter connector
    d. Disconnect the two heated oxygen sensor connectors
    e. Disconnect the Park/Neutral Position (PNP) switch connector
    f. Remove the two bolts and disconnect the engine wire from the intake manifold and the cylinder block
    g. Disconnect the PCV hose from the PCV valve
    h. Remove the bolt holding the engine wire to the intake manifold
    i. Unplug the connector for the emission control valve set assembly and the three injector connectors
    j. Disconnect the engine wire harness clamp
    k. Disconnect the EGR gas temperature sensor connector
    l. Disconnect the clamp of the No. 6 injector wire from the bracket
    m. Disconnect the engine wire harness from the cylinder head and the intake manifold
26. Remove the three bolts and disconnect the water bypass pipe from the cylinder head.
27. Disconnect the heated oxygen sensor connector.
28. Remove the nuts and bolts holding the front exhaust pipe to the rear TWC.
29. Disconnect the front exhaust pipe and remove the gasket.
30. Remove the clamp from the support bracket and remove the bracket.
31. Remove the front exhaust pipe and the gaskets.
32. Remove the exhaust manifolds.
    a. Remove the heat insulators.
33. Remove the ground cable, heater pipe and gasket.
34. Remove the water bypass outlet and the pipe. Remove the three O-rings from the water bypass outlet and the pipe.
35. Remove the valve cover.
36. Remove the semi-circular plug from the cylinder head.
37. Remove the spark plugs.
38. Set the No. 1 cylinder to TDC of the compression stroke as follows:
    a. Turn the crankshaft pulley and align its groove with the **0** mark on the timing chain cover.
    b. Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface. If not, turn the crankshaft one revolution (360°) and align the marks as above.
39. Remove the chain tensioner.
40. Place matchmarks on the camshaft timing gear and the timing chain.
41. Hold the intake camshaft with a wrench and remove the bolt and the distributor gear.
42. Remove the camshaft timing gear and chain from the intake camshaft and leave on the slipper and the damper.
43. Remove the camshafts.

⁂WARNING

Do not pry on or attempt to force the camshaft with a tool or any other object.

44. Remove the two bolts in the front of the head first.
45. Loosen and remove the 14 cylinder head bolts in sequence using several passes.

⁂WARNING

Cylinder head warpage or cracking could result from removing bolts in incorrect order.

46. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on the

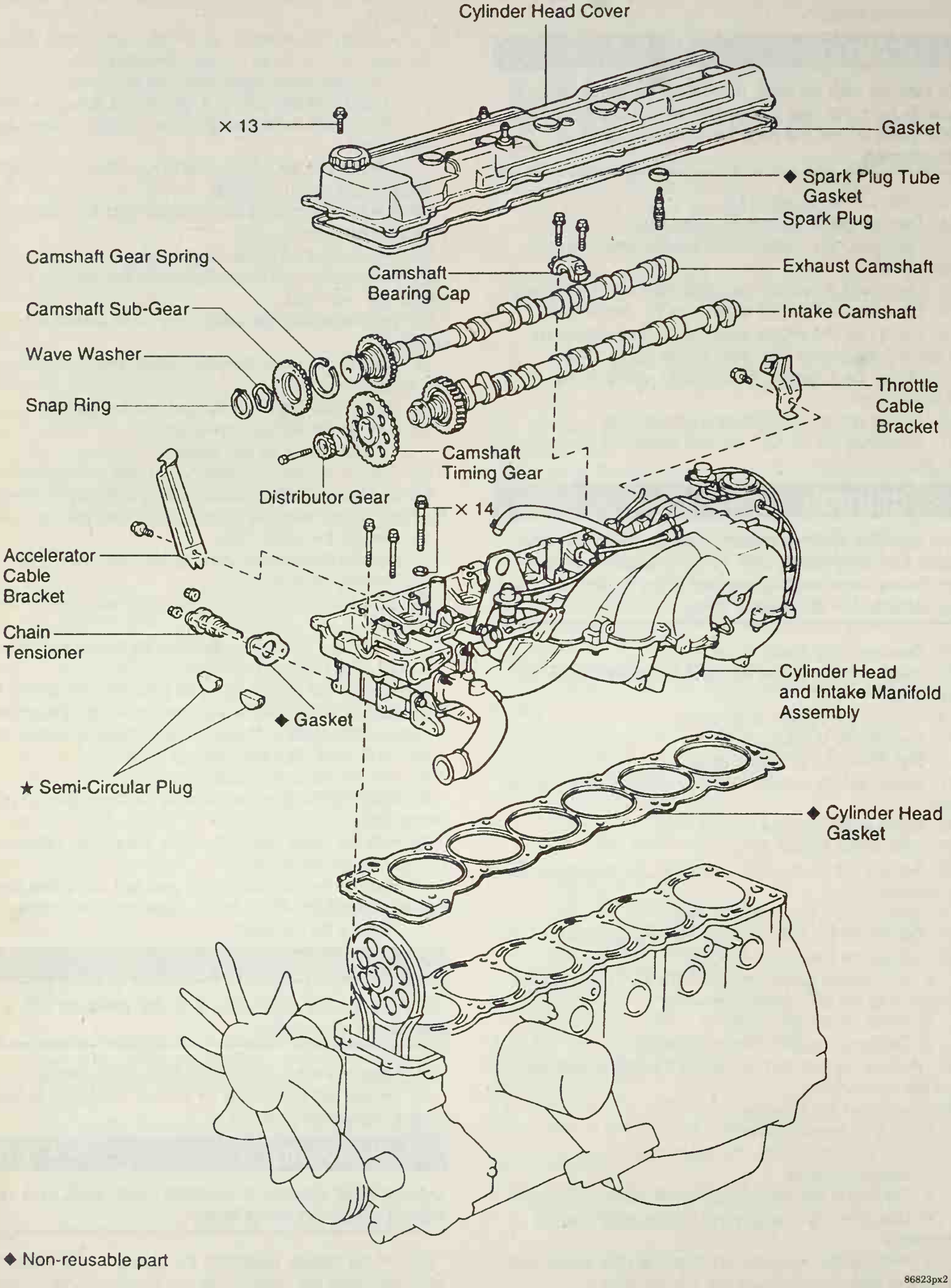
Cylinder Head Cover
× 13
Gasket
◆ Spark Plug Tube Gasket
Spark Plug
Camshaft Gear Spring
Camshaft Bearing Cap
Exhaust Camshaft
Camshaft Sub-Gear
Intake Camshaft
Wave Washer
Snap Ring
Throttle Cable Bracket
Camshaft Timing Gear
Distributor Gear
× 14
Accelerator Cable Bracket
Chain Tensioner
Cylinder Head and Intake Manifold Assembly
◆ Gasket
★ Semi-Circular Plug
◆ Cylinder Head Gasket
◆ Non-reusable part
86823px2

Fig. 184 Exploded view of the cylinder head components — 1FZ-FE engine

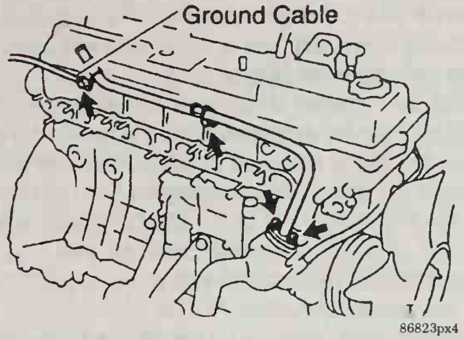
Ground Cable
86823px4

Fig. 185 The ground cable is secured to the front of the heater pipe

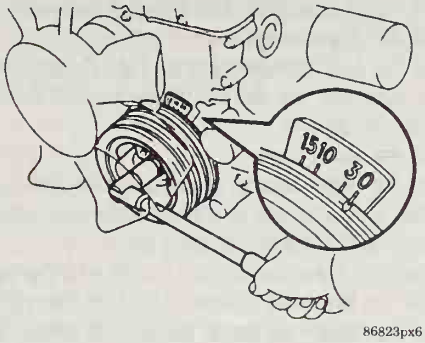
15 10
30
86823px6

Fig. 186 Turn the crankshaft pulley and align its groove with the 0 mark on the timing chain cover

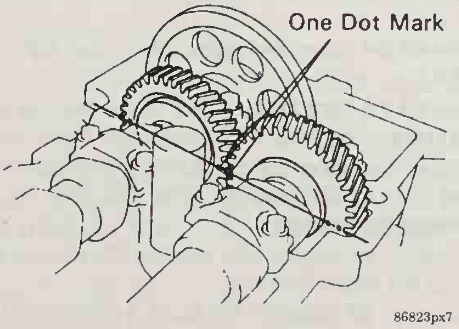
One Dot Mark
86823px7

Fig. 187 Check that the marks on the camshaft pulley are aligned

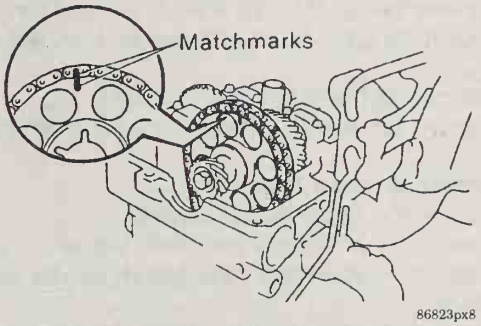
Matchmarks
86823px8

Fig. 188 Matchmark the position of the chain on the gear

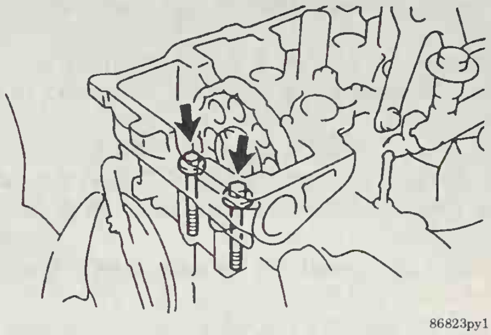

Fig. 189 Remove these two bolts prior to the rest of the head bolts

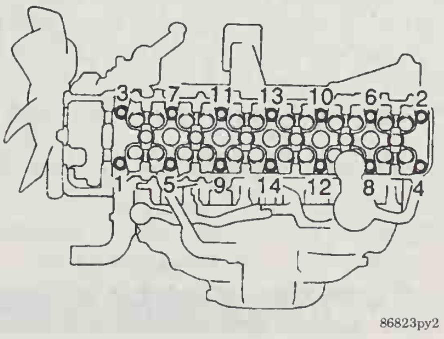
3
7
11
13
10
6
2
1
5
9
14
12
8
4
86823py2

Fig. 190 Uniformly loosen and remove the 14 head bolts in several passes

bench. If the cylinder head is difficult to lift off, pry between the cylinder head and the cylinder block with a flat prying tool.

47. Remove the alternator bracket.

48. Remove the two nuts, the water outlet, and the gasket.

49. Loosen the union nut and remove the EGR pipe and gasket.

50. Remove the heater inlet pipe and hose.

51. Remove the air intake chamber and the intake manifold assembly.

52. Remove the water bypass hose.

53. Remove the engine hanger brackets.

54. Remove the two engine wire clamp brackets.

55. Remove the accelerator cable bracket and the throttle cable bracket.

56. Remove the valve lifters and shims. Arrange the valve lifters and shims in correct order for reinstallation.

To install:

57. Install the valve lifters and shims. Check to make sure that the valve lifter rotates smoothly by hand.

58. Install the accelerator cable bracket and the throttle cable bracket.

59. Install the engine wire clamp brackets.

60. Install the engine hangers. Tighten to 30 ft. lbs. (41 Nm).

61. Install the air intake chamber and intake manifold assembly.

62. Install the heater hose to the cylinder head, and connect the pipe to the intake manifold. Tighten the bolts to 15 ft. lbs. (21 Nm).

63. Temporarily install the union nut to the EGR valve. Install the EGR pipe to the cylinder head. Tighten the bolts to 15 ft. lbs. (21 Nm). Tighten the union nut to 58 ft. lbs. (78 Nm).

64. Install a new gasket and the water outlet. Tighten the nuts to 15 ft. lbs. (21 Nm).

65. Install the alternator bracket and tighten the bolts to 32 ft. lbs. (43 Nm).

66. Apply sealant on the end of the engine block by the timing belt.

67. Install a new cylinder head gasket on the cylinder block.

68. Install the cylinder head.

69. Install the cylinder head bolts as follows:

a. The cylinder head bolts are tightened in three progressive steps. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

b. Install the 14 cylinder head bolts and tighten progressively in sequence to 29 ft. lbs. (39 Nm). Use the reverse of the loosening sequence.

c. Mark the front of the cylinder head bolt head with paint.

d. Retighten the cylinder head bolts by 90° in numerical order.

e. Retighten the cylinder head bolts an additional 90° so that the painted mark is now facing to the rear.

⁂WARNING

Do not combine steps D and E in one pass; the above steps must be followed exactly and in order to prevent cylinder head damage or pre-mature gasket failure.

f. Install and tighten the two bolts at the front of the head to 15 ft. lbs. (21 Nm).

70. Install the camshafts.

71. Set the No. 1 cylinder to TDC of the compression stroke. Turn the crankshaft pulley, and align its groove with the timing mark **0** of the timing chain cover. Turn the camshaft so that the timing marks with one and two dots will be in straight line on the cylinder head surface.

72. Install the camshaft timing gear as follows:

a. Check that the matchmarks on the camshaft timing gear and the timing chain are aligned. Place the gear over the straight pin of the intake camshaft.

b. Align the straight pin of the distributor gear with the straight pin groove of the intake camshaft gear.

c. Hold the intake camshaft with a wrench, install and tighten the bolt to 54 ft. lbs. (74 Nm).

73. Install the chain tensioner. Push the tensioner by hand until it touches the head installation surface, then install and tighten the two nuts to 15 ft. lbs. (21 Nm).

74. Turn the crankshaft pulley, and align its groove with the timing mark **0** of the timing chain cover. Always turn the crankshaft clockwise. Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface. If not, turn the crankshaft one revolution (360°) and align the marks.

75. Check valve clearance and adjust if necessary.

76. Install the spark plugs.

77. Install the semi-circular plug to the cylinder head.

78. Make sure that the No. 1 cylinder is in TDC of the compression stroke.

79. Install the valve cover.

80. Install the water bypass outlet and the pipe as flows:

a. Install a new O-ring to the water bypass outlet. Install new O-rings to the water bypass pipe.

b. Assemble the water bypass outlet and the pipe and install with the two bolts tightened to 15 ft. lbs. (21 Nm).

81. Install the heater pipe and the ground cable. Tighten the heater pipe bolt to 14 ft. lbs. (20 Nm) and the nut to 15 ft. lbs. (21 Nm).

82. Install the exhaust manifolds. Tighten the nuts to 29 ft. lbs. (39 Nm).

83. Install the insulator and heat insulator and tighten the bolts to 14 ft. lbs. (20 Nm).

84. Install the front exhaust pipe. Tighten the nuts to 46 ft. lbs. (63 Nm).

85. Install the support bracket and tighten to 17 ft. lbs. (24 Nm).

86. Connect the clamp and tighten the clamp bolt to 14 ft. lbs. (20 Nm).

87. Connect the front exhaust pipe to the rear catalytic converter and tighten the bolts to 34 ft. lbs. (46 Nm).

88. Connect the water bypass pipe to the cylinder head and tighten the bolts to 14 ft. lbs. (20 Nm).

89. Connect the following:

a. Connect the engine wire harness from the cylinder head and the intake manifold

b. Connect the clamp of the No. 6 injector wire from the bracket

c. Connect the EGR gas temperature sensor connector

d. Connect the engine wire harness clamp

e. Attach the connector for the emission control valve set assembly and the three injector connectors

f. Install the bolt holding the engine wire to the intake manifold

g. Connect the PCV hose from the PCV valve

h. Install the two bolts and connect the engine wire from the intake manifold and the cylinder block

i. Connect the Park/Neutral Position (PNP) switch connector

j. Connect the two heated oxygen sensor connectors

k. Starter connector

l. Two connectors from the transmission

m. Oil level sensor connector

90. Install the bolt and connect the engine wire harness from the cylinder block.

91. Engage the following connectors:

a. ECT sender gauge connector, the ECT cut switch connector, and the ECT sensor connector

b. Knock sensor connector

c. Crankshaft position sensor connector

92. Connect the fuel inlet hose to the fuel filter with the union bolt. Tighten to 22 ft. lbs. (29 Nm).

93. Install the intake manifold stay and tighten the bolts to 26 ft. lbs. (36 Nm).

94. Install the oil dipsticks and the guides for the engine and the transmission. Tighten the oil dipstick guide bolts to 14 ft. lbs. (20 Nm).

95. Install the throttle body.

96. Install the alternator and the drive belts.

97. Connect the water bypass hose.

98. Connect the radiator inlet hose.

99. Connect the P/S reservoir tank and tighten the bolts to 14 ft. lbs. (20 Nm).

100. Install the distributor.

101. Install the cylinder head covers.

102. Connect the heater valve and the engine wire harness to the cowl panel.

103. Connect the heater hoses.

104. Connect the fuel return hose, the EVAP hose, and the brake booster vacuum hose.

105. Attach the connector on the intake manifold to the left fender apron.

106. Connect the ground strap to the engine hanger and the air intake chamber.

107. Attach the throttle cable to the throttle body. Adjust the throttle cable.

108. Connect the accelerator cable to the throttle body.

109. Connect the cruise control actuator cable to the the throttle body.

110. Install the air cleaner hose and cap.

111. Install the battery tray, the battery, and connect the cables.

112. Refill the engine coolant.

113. Start the engine and check for leaks.

114. Make necessary engine adjustments.

115. Road test the vehicle and recheck the engine coolant level.

CLEANING AND INSPECTION

➧ See Figures 191, 192, 193 and 194

When the rocker assembly and valve train have been removed from the cylinder head, set the head on two wooden blocks on the bench, combustion chamber side up. Using a scraper or putty knife, carefully scrape away any gasket material that may have stuck to the head-to-block mating surface when the head was removed. Make sure you DO NOT gouge the mating surface with the tool. Wood, plastic or even brass scrapers are best.

Using a wire brush attached to your electric drill, remove the carbon in each combustion chamber. Make sure the brush is actually removing the carbon and not merely burnishing it.

Clean all the valve guides using a valve guide brush (available at most auto parts or auto tool shops) and solvent. A fine-bristled rifle bore cleaning brush also works here.

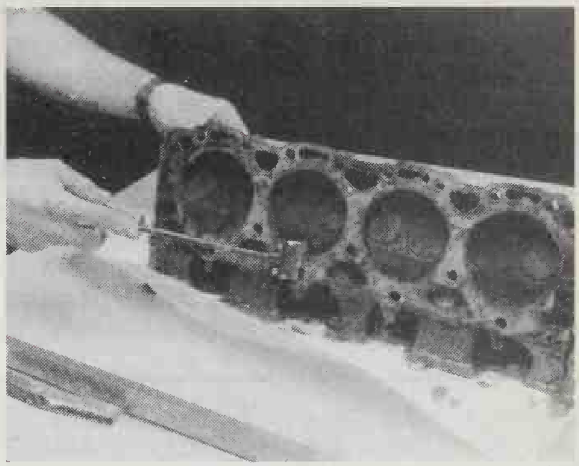
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Fig. 191 Use a gasket scraper to remove the bulk of the old head gasket from the mating surface

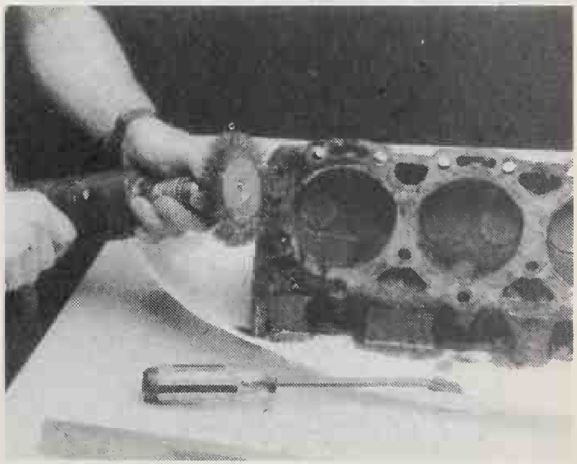
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Fig. 192 An electric drill equipped with a wire wheel will expedite complete gasket removal

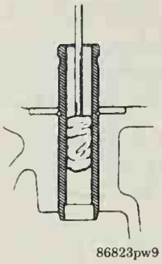


Fig. 193 Using a valve guide brush, clean the bore with solvent

Inspect the threads of each spark plug hole by screwing a plug into each, making sure it screws down completely. Heli-coil® any plug hole that is damaged.

⁂WARNING

You may wish to send the bare head to a machine shop for cleaning. There are many ways to clean the head including solvent baths and glass bead blasting. DO NOT hot tank the cylinder head. The head material on most engines is aluminum, which is ruined if subjected to the hot tank solution.

To inspect for cracks, use a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface. If cracked, replace the head.

Finally, go over the entire head with a clean shop rag soaked in solvent to remove any grit, old gasket particles, etc. Blow out the bolt holes, coolant galleys, intake and exhaust ports, valve guides and plug holes with compressed air.

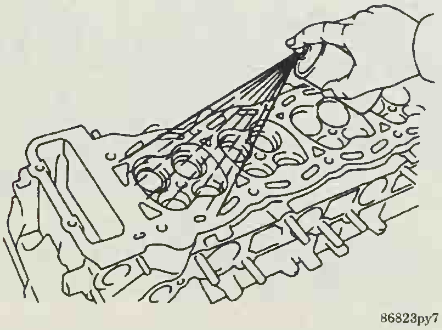


Fig. 194 Spray a dye penetrant to check for cracks

RESURFACING

➧ See Figures 195 and 196

While the head is removed, check the head-to-block mating surface for straightness. If the engine has overheated and blown a head gasket, this must be done as a matter of course. A warped mating surface must be resurfaced (milled). This is done by a machine shop on a milling machine and is quite similar to planing a piece of wood.

Using a precision steel straight-edge and a blade-type feeler gauge, check the surface of the head across its length, width and diagonal length. Also check the intake and exhaust manifold mating surfaces and cam cover mating surfaces. If warpage exceeds 0.0039 in (0.010mm), the head must be replaced. Warpage under this amount allows resurfacing, if done carefully.

If the head is sent out for resurfacing, have it crack checked at the same time. The few dollars extra is worth the peace of mind.

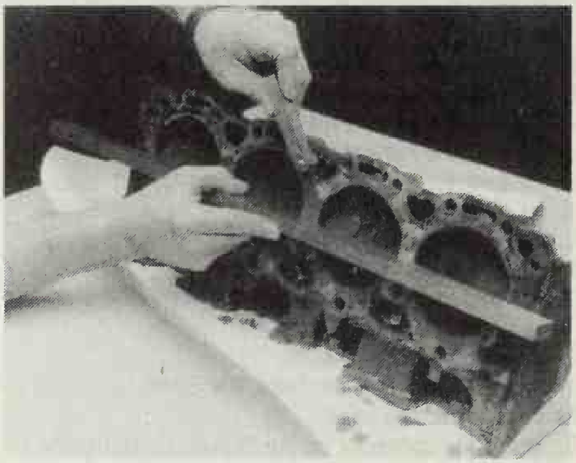


Fig. 195 Check the cylinder head for warpage along the center using a straightedge and a feeler gauge

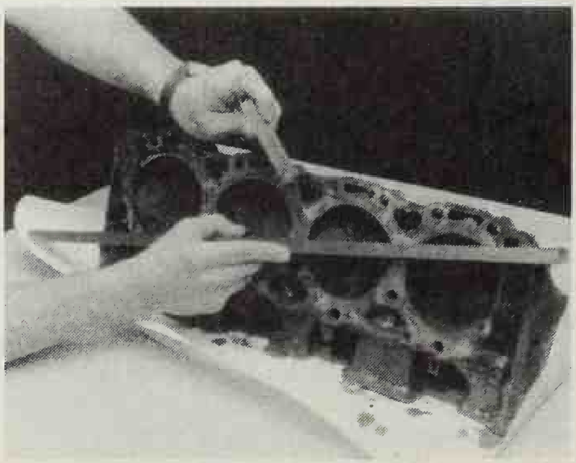


Fig. 196 Be sure to check for warpage across the cylinder head at both diagonals

CYLINDER BLOCK CLEANING

While the cylinder head is removed, the top of the cylinder block and pistons should also be cleaned. Before you begin, rotate the crankshaft until one or more pistons are flush with the top of the block (on the four cylinder engines, you will either have Nos. 1 and 4 up, or Nos. 2 and 3 up). Carefully stuff clean rags into the cylinders in which the pistons are down. This will help keep grit and carbon chips out during cleaning. Using care not to gouge or scratch the block-to-head mating surface and the piston top(s), clean away any old gasket material with a wire brush and/or scraper. On the piston tops, make sure you are actually removing the carbon and not merely burnishing it.

Remove the rags from the down cylinders after you have wiped the top of the block with a solvent soaked rag. Rotate the crankshaft until the other pistons come up flush with the top of the block, and clean those pistons.

➡Because you have rotated the crankshaft, you will have to re-time the engine following the procedure listed under the Timing Chain/Timing Belt removal. Make sure you wipe out each cylinder thoroughly with a solvent-soaked rag, to remove all traces of grit, before the head is reassembled to the block. Any particles trapped by the piston will score the cylinder wall.

Valves and Springs

REMOVAL & INSTALLATION

➧ See Figures 197, 198, 199, 200 and 201

A valve spring compressor is needed to remove the valves and springs; these are available at most auto parts and auto tool shops. A small magnet is very helpful for removing the keepers and spring seats.

Set the head on its side on the bench. Install the spring compressor so that the fixed side of the tool is flat against the valve head in the combustion chamber, and the screw side is against the retainer. Slowly turn the screw in towards the head, compressing the spring. As the spring compresses, the keepers will be revealed; pick them off of the valve stem with the magnet as they are easily fumbled and lost. When the keepers are removed, back the screw out and remove the retainers and springs. Remove the compressor and pull the valves out of the head from the other side. Remove the valve seals by hand and remove the spring seats with the magnet.

Since it is very important that each valve and its spring, retainer, spring seat and keepers is reassembled in its original location, you must keep these parts in order. The best way to do this to cut either eight (for four cylinder) or twelve (for six cylinder) holes in a piece of heavy cardboard or wood. Label each hole with the cylinder number and either **IN** or **EX**, corresponding to the location of each valve, intake or exhaust, in the head. As you remove each valve, insert it into the holder, and assemble the seats, springs, keepers and retainers to the stem on the labeled side of the holder. This way each valve and its attendant parts are kept together, and can be put back into the head in their proper locations.

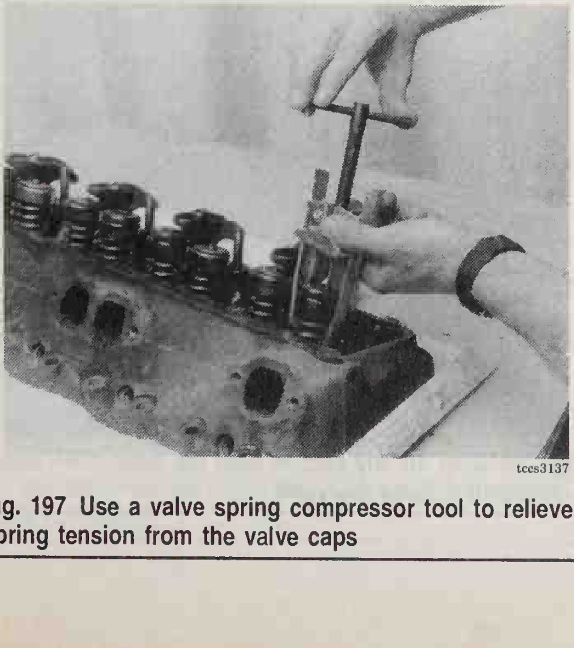

tccs3137

Fig. 197 Use a valve spring compressor tool to relieve spring tension from the valve caps

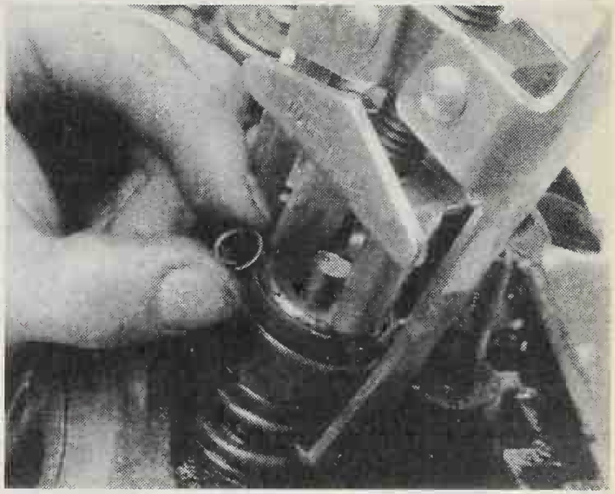

tccs3139

Fig. 198 Be careful not to lose the valve keepers

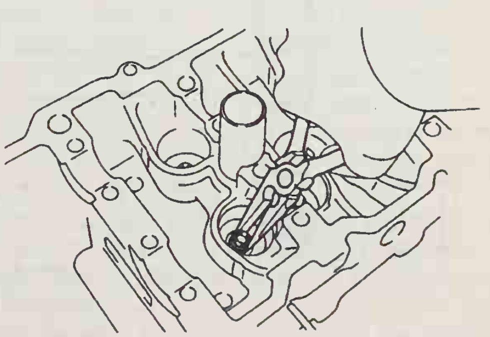

86823py9

Fig. 199 Use a pair of needle nose pliers to remove the oil seal

After lapping each valve into its seat (see Valve Lapping), oil each valve stem, and install each valve into the head in the reverse order of removal, so that all parts except the keepers are assembled on the stem. Always use new valve stem seals.

➡Some engines use valve rotators in place of the spring retainer. These disassemble and reassemble in the same fashion but use different valve keepers. The keepers are not interchangeable.

Install the spring compressor, and compress the retainer (or rotator) and spring until the keeper groove on the valve stem is fully revealed. Coat the groove with a wipe of grease (to hold the keepers until the retainer is released) and install both keepers, wide end up. Slowly back the screw of the compressor out until the spring retainer covers the keepers. Remove the tool. Lightly tap the end of each valve stem with a rubber hammer to ensure proper fit of the retainers and keepers.

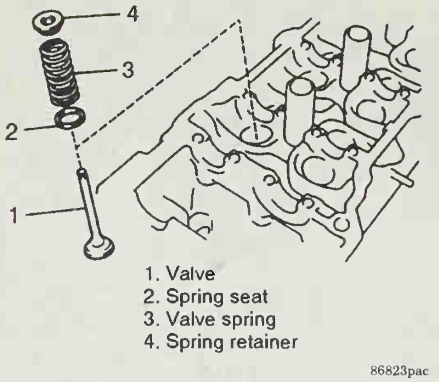


Fig. 200 Exploded view of the valve and components

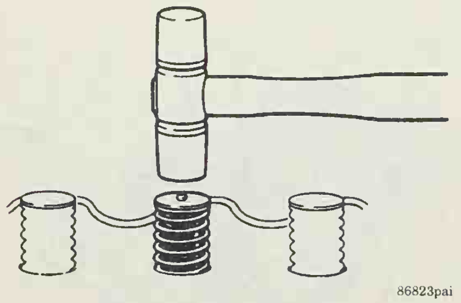


Fig. 201 Lightly tap the end of each valve stem with a rubber hammer to ensure proper fit of the retainers and keepers

INSPECTION

➧ See Figures 202, 203, 204, 205 and 206

Before the valves can be properly inspected, the stem, lower end of the stem and the entire valve face and head must be cleaned. An old valve works well for chipping carbon from the valve head, and a wire brush, gasket scraper or putty knife can be used for cleaning the valve face and the area between the face and lower stem. Do not scratch the valve face during cleaning. Clean the entire stem with a rag soaked in thinner to remove all varnish and gum.

Thorough inspection of the valves requires the use of a micrometer, and a dial indicator is needed to measure the inside diameter of the valve guides. If there instruments are not available to you, the valves and head can be taken to a reputable machine ship for inspection. Refer to the Valve Specifications chart for valve stem and stem-to-guide specifications.

If the above instruments are at your disposal, measure the diameter of each valve stem at the top, middle, and bottom of the stem. Measure in two dimensions (when viewed from the top of the stem). This is six measurements per valve; jot these measurements down in order for each valve.

Using the dial indicator, measure the inside diameter of the valve guides at their bottom, top and midpoint, again in two dimensions. Six measurements for each guide; jot these measurements down also.

Subtract the valve stem measurement from the valve guide inside measurement; if the clearances exceed that listed in the specifications chart under Stem-to-Guide Clearance, replace the valve(s). Stem-to-guide clearance can also be checked at a machine shop, where a dial indicator would be used.

Check the top of each valve stem for pitting, mushrooming and unusual wear due to improper rocker adjustment, etc. The stem tip can be ground flat if it is worn, but no more than 0.02 in. (0.50mm) can be removed; If this limit must be exceeded to make the tip flat and square, then the valve must be replaced. If the valve stem tips are ground, make sure you fix the valve securely into a jig designed for this purpose, so the tip con-

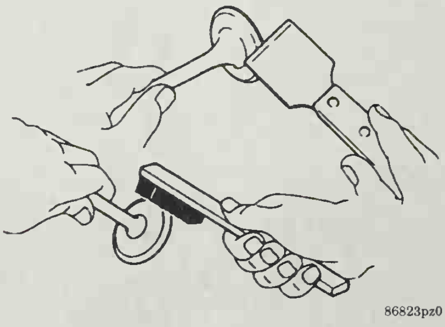


Fig. 202 Chip off any carbon from the head, then using a wire brush, clean the valve

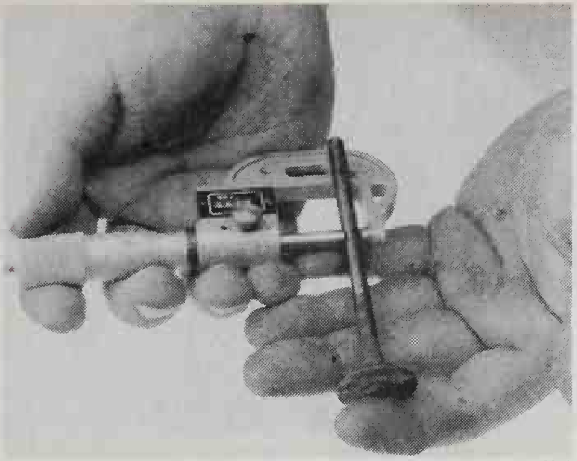


Fig. 203 Use a micrometer to check the valve stem diameter

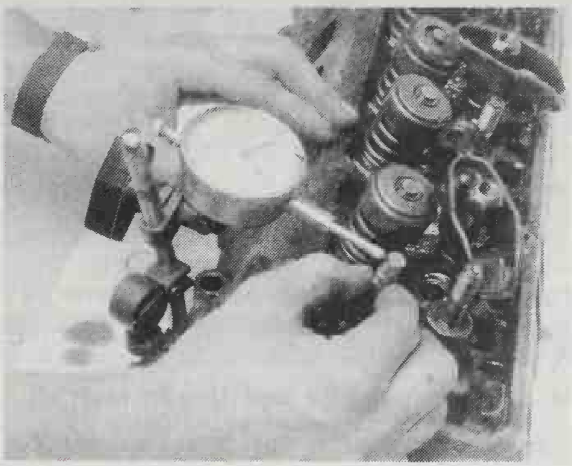


Fig. 204 A dial gauge may be used to check valve stem-to-guide clearance

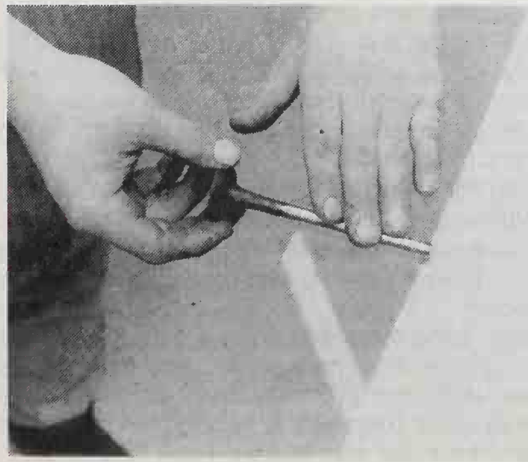


Fig. 205 Valve stems may be rolled on a flat surface to check for bends

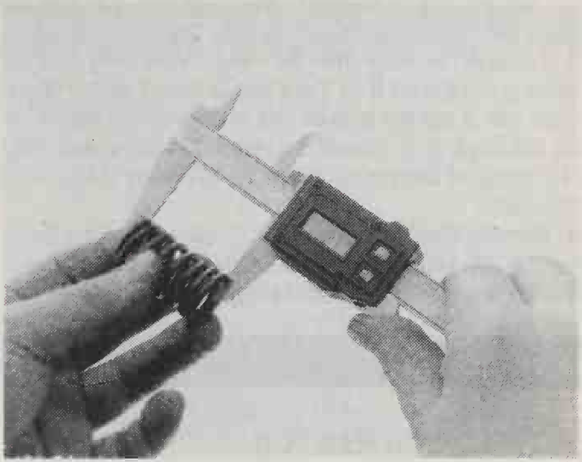


Fig. 206 Use a caliper gauge to check the valve spring free-length

tacts the grinding wheel squarely at exactly 90°. Most machine shops that handle automotive work are equipped for this job.

REFACING

Valve refacing should only be handled by a reputable machine shop, as the experience and equipment needed to do the job are beyond that of the average owner/mechanic. During the course of a normal valve job, refacing is necessary when simply lapping the valves into their seats will not correct the seat and face wear. When the valves are reground (resurfaced), the valve seats must also be recut, again requiring special equipment and experience.

VALVE LAPPING

After machine work has been performed on the valves, it may be necessary to lap the valve to assure proper contact. For this, you should first contact your machine shop to determine if lapping is necessary. Some machine shops will perform this for you as part of the service, but the precision machining which is available today often makes lapping unnecessary. Additionally, the hardened valves/seats used in modern automobiles may make lapping difficult or impossible. If your machine shop recommends that you lap the valves, proceed as follows:

1. Set the cylinder head on the workbench, combustion chamber side up. Rest the head on wooden blocks on either end, so there are two or three inches between the tops of the valve guides and the bench.
2. Lightly lube the valve stem with clean engine oil. Coat the valve seat completely with valve grinding compound. Use just enough compound that the full width and circumference of the seat are covered.
3. Install the valve in its proper location in the head. Attach the suction cup end of the valve lapping tool to the valve head. It usually helps to put a small amount of saliva into the suction cup to aid it sticking to the valve.
4. Rotate the tool between the palms, changing position and lifting the tool often to prevent grooving. Lap the valve in

until a smooth, evenly polished seat and valve face are evident.

5. Remove the valve from the head. Wipe away all traces of grinding compound from the valve face and seat. Wipe out the port with a solvent soaked rag, and swab out the valve guide with a piece of solvent soaked rag to make sure there are no traces of compound grit inside the guide. This cleaning is important.

6. Proceed through the remaining valves, one at a time. Make sure the valve faces, seats, cylinder ports and valve guides are clean before reassembling the valve train.

Valve Springs

REMOVAL & INSTALLATION

Spring removal is part of the valve removal and installation procedure.

INSPECTION

See Figures 207 and 208

Valve spring squareness, length and tension should be checked while the valve train is disassembled. Place each valve spring on a flat surface next to a steel square. Measure the length of the spring, and rotate it against the edge of the square to measure distortion. If spring length varies (by comparison) by more than 1.6mm or if distortion exceeds 1.6mm, replace the spring.

Spring tension must be checked on a spring tester. Springs used on most Toyota engines should be within one pound of each other when tested at their specified installed heights.

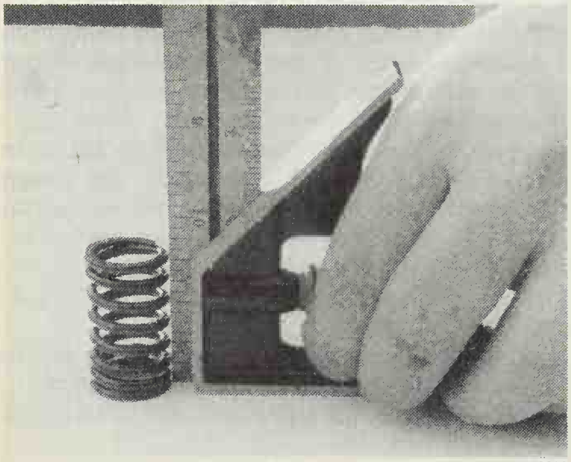

tccs3908

Fig. 207 Check the valve spring for squareness on a flat service; a carpenter's square can be used

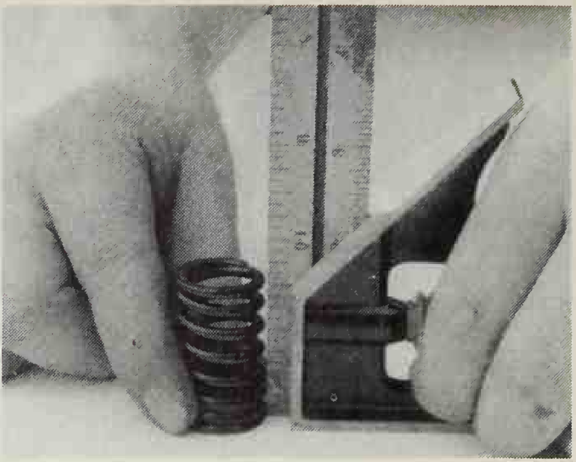

tccs3909

Fig. 208 The valve spring should be straight up and down when placed like this

Valve Seals

REMOVAL & INSTALLATION

Cylinder Head Removed

1. Remove the head(s), and place on a clean surface.

2. Using a suitable spring compressor, compress the valve spring and remove the valve spring cap key. Release the spring compressor and remove the valve spring and cap (and valve rotator on some engines).

➡Use care in removing the keys. They are easily lost.

3. Remove the valve seals from the intake valve guides. Throw these old seals away, as you'll be installing new seals during reassembly.

New valve seals must be installed when the valve train is put back together. Certain seals slip over the valve stem and guide boss, while others require that the boss be machined. Teflon® guide seals are available. Check with a machinist and/or automotive parts store for a suggestion on the proper seals to use.

To install:

4. Lubricate the valve stems with clean engine oil.

5. Lubricate and position the seals and valve springs, again a valve at a time.

6. Install the spring retainers, and compress the springs.

7. With the valve key groove exposed above the compressed valve spring, wipe some wheel bearing grease around the groove. This will retain the keys as you release the spring compressor.

8. Using needlenose pliers (or your fingers), place the keys in the key grooves. The grease should hold the keys in place. Slowly release the spring compressor. The valve cap or rotator will raise up as the compressor is released, retaining the keys.

9. Install the rocker assembly, and install the cylinder head(s).

Cylinder Head Installed

➡**A special air line adaptor will be necessary for this job.**

It is often not necessary to remove the cylinder head(s) in order to service the valve train. Such is the case when valve seals need to be replaced. Valve seals can be easily replaced with the head(s) on the engine. The only special equipment needed for this job are an air line adapter (sold in most auto parts stores) and a valve spring compressor. A source of compressed air is needed, of course.

1. Remove the cylinder head cover.
2. Remove the spark plugs.
3. Remove the camshaft(s) and rocker arms (if equipped).
4. Position the engine so that both valves are closed.
5. Install the air line adapter into the spark plug hole. Turn on the air compressor to apply compressed air into the cylinder. This keeps the valves up in place.

➡**Set the regulator of the air compressor at least 50 psi. (344 kPa) to ensure adequate pressure.**

6. Using the valve spring compressor, compress the valve spring and remove the valve keys and keepers, the valve spring and damper.
7. Remove the valve stem seal.
8. To reassemble, oil the valve stem and new seal. Install a new seal over the valve stem. Set the spring, damper and keeper in place. Compress the spring. Coat the keys with grease to hold them onto the valve stem and install the keys, making sure they are seated fully in the keeper. Install the remaining components in the reverse order of removal.

Valve Seats

REMOVAL & INSTALLATION

The valve seats in the engines covered in this guide are all non-replaceable, and must be recut when service is required. Seat recutting requires a special tool and experience, and should be handled at a reputable machine shop. Seat concentricity should also be checked by a machinist.

Valve Guides

REMOVAL & INSTALLATION

Valve guide replacement on all Toyota engines requires breaking off the top end of the guides, heating the cylinder head to almost 200°F (93°C), then driving the rest of the guide out of the head with a hammer and drift. This procedure requires special tools and experience, and should be handled by a reputable machine shop.

Valve Lifters

REMOVAL & INSTALLATION

▶ See Figures 209, 210 and 211

Only the 3F-E engine uses valve lifters. These are cylindrical devices between the bottom of the pushrod and the lobe of the camshaft. The lifter follows the motion of the camshaft lobe, meeting it with a broad smooth face. The pushrod would not stay in place on the cam lobe if the lifter were not present.

1. Remove the valve rocker shaft assembly and pushrods, following procedures outlined in this section.
2. Remove the pushrod cover, the long panel on the side of the engine block.
3. Remove the lifters, keeping them in order. The surfaces of the lifter have become matched to the respective cam lobe and pushrod; interchanging will increase wear. Some of the lifters will be down inside the bores; a magnetic finger tool will be useful.
4. Clean each lifter thoroughly. Use a micrometer to measure lifter diameter. Standard diameter is 0.8420-0.8427 inch (21.387mm-21.404mm).

To install:

5. Install the lifters in their correct location. A light coat of clean oil is helpful. Make certain the lifters are not upside down.
6. Install a new pushrod cover gasket and install the cover. Tighten the nuts and bolts to 35 inch lbs. (4 Nm). This is little more than finger-tight; do not overtighten.
7. Install the rocker shaft assembly.

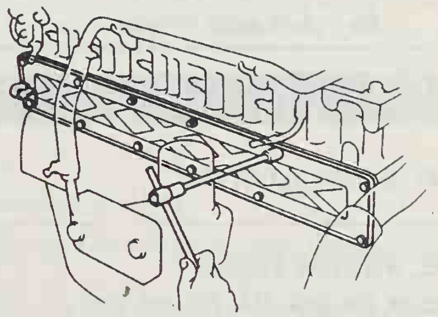


Fig. 209 Remove the pushrod cover located on the side of the block

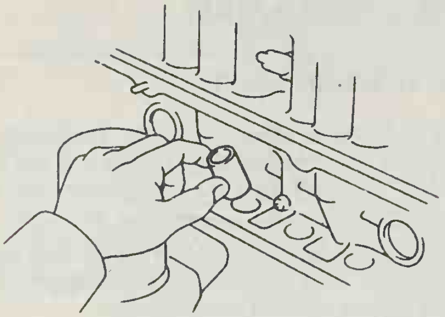


Fig. 210 Remove the lifters from the bores . . .

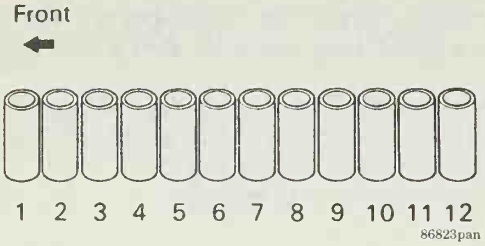


Fig. 211 . . . then place them in order

Oil Pan

REMOVAL & INSTALLATION

22R, 22R-E, and 3VZ-E Engines

➧ See Figures 212, 213, 214, 215 and 216

1. Elevate the front of the vehicle and support it securely on stands.
2. Remove the undercover from the engine.
3. Drain the oil and discard of the drain plug gasket.

➡If you haven't replaced the oil filter lately, you may want to for a complete oil change.

⁂CAUTION

Used motor oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Although this is unlikely unless you handle oil on a daily basis, it is wise to thoroughly wash your hands with soap and water immediately after handling used motor oil.

4. If the truck or 4Runner is 4WD, remove the front differential.
5. For 22R and 22R-E engines, remove the engine mounting bolts. Position a floor jack under the transmission and raise the engine/transmission assembly slightly.
6. Remove the oil pan bolts and remove the oil pan. If the pan is difficult to remove do NOT pry with screwdrivers or similar tools; the flange of the pan will be deformed. Tap the bottom or side of the pan with a wooden or plastic mallet to dislodge the pan from the block. If this is still not sufficient, make a wooden wedge and gently tap it into the seam.
7. Use a razor blade to scrape the cylinder block and oil pan mating surfaces clean of any old sealing material. All traces of the old gasket and sealer must be removed.
8. Clean the pan thoroughly, using solvent if necessary. If the pan has a magnet in it, examine the catchings closely; excess metal is a sign of excess engine wear. A few slivers are normal. Use good judgment in relating the amount of debris to the amount of time the pan has been in place.

➡Do not use a solvent which will affect the paint on the pan. Flecks of paint remaining in the pan can plug the oil pick-up or dissolve in the oil, polluting it.

To install:

9. On 22R, 22R-E and 3VZ-E engines, the pan does not use a pre-made gasket; all sealing is accomplished by correct application of sealant from a tube. Cut the tip of the tube to produce a bead about 2/10 inch (5mm) only. Place the continuous bead of sealant in the groove, looping to the inside of

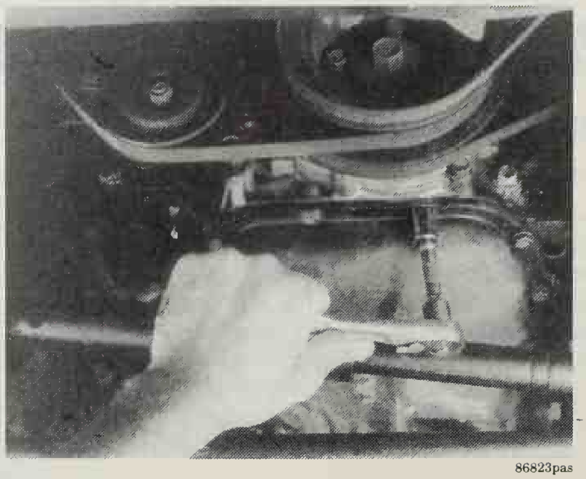
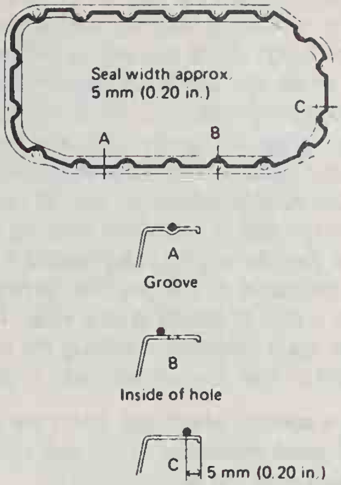


Fig. 212 It may be necessary to use an extension to reach the bolts retaining the oil pan

86823pat

Fig. 213 Be careful when lowering the pan, some oil may be left in it



86823pau

Fig. 215 Apply the sealant to the pan as shown

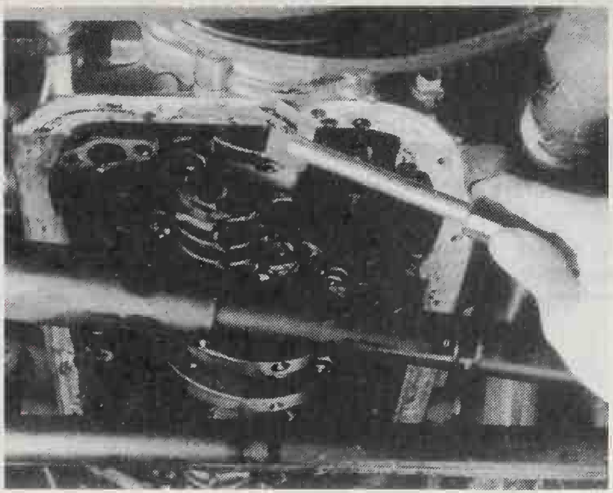

86823pla

Fig. 214 Scrape the block of any old sealant left behind

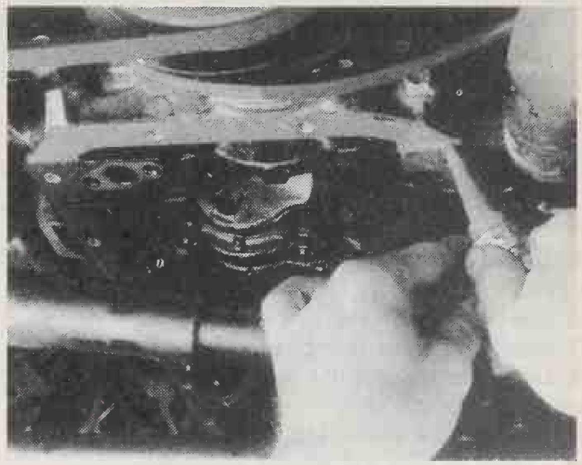

86823plc

Fig. 216 For 22R and 22R-E engines, apply sealant to the 4 corners of the cylinder block

the bolt holes and keeping about 2/10 inch (5mm) from the edge of the pan.

10. For 22R, and 22R-E, apply sealant to the 4 points on the cylinder block at the chain cover and rear oil seal retainer.
11. Install the pan to the block within about 5 minutes of applying the sealer and install the retaining bolts and nuts finger-tight.
12. Tighten the nuts and bolts, working from the center of the pan in a circular pattern to the ends. For 22R and 22R-E, tighten to 9 ft. lbs. (13 Nm); for 3VZ-E engines, 52 inch lbs. (6 Nm).
13. For 22R and 22R-E engines, lower the engine/transmission into place and install the motor mount bolts.
14. Double check the oil drain plug and gasket. Make certain it is present and correctly tightened in the pan.
15. Add oil to the engine.
16. Install the front differential if it was removed.
17. Install the engine undercover.
18. Lower the vehicle to the ground. Start the engine and check for leaks.
19. Road test the vehicle and, upon returning, check for leaks. Inspect oil level and adjust if necessary.

3F-E Engine

➧ See Figures 217 and 218

1. Elevate the front of the vehicle and support it securely on stands.
2. Remove the undercover from the engine.
3. Drain the oil and discard of the drain plug gasket.

➡If you haven't replaced the oil filter lately, you may want to for a complete oil change.

✲✲CAUTION

Used motor oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Although this is unlikely unless you handle oil on a daily basis, it is wise to thoroughly wash your hands with soap and water immediately after handling used motor oil.

4. Remove the oil pan bolts and remove the oil pan. If the pan is difficult to remove do NOT pry with screwdrivers or similar tools; the flange of the pan will be deformed. Tap the bottom or side of the pan with a wooden or plastic mallet to dislodge the pan from the block. If this is still not sufficient, make a wooden wedge and gently tap it into the seam.

5. Use a razor blade or equivalent to scrape the cylinder block and oil pan mating surfaces of any old sealing material. All traces of the old gasket and sealer must be removed.

6. Clean the pan thoroughly, using solvent if necessary. If the pan has a magnet in it, examine the catchings closely; excess metal is a sign of excess engine wear. A few slivers are normal. Use good judgment in relating the amount of debris to the amount of time the pan has been in place.

➡Do not use a solvent which will affect the paint on the pan. Flecks of paint remaining in the pan can plug the oil pick-up or dissolve in the oil, polluting it.

To install:

7. On 3F-E, install a new gasket on the pan without sealant.

8. Apply sealant to the 4 points on the cylinder block at the chain cover and rear oil seal retainer.

9. Install the pan to the block within about 5 minutes of applying the sealer and install the retaining bolts and nuts finger-tight.

10. Tighten the nuts and bolts. Working from the center of the pan in a circular pattern to the ends to 69 inch lbs. (8 Nm).

11. Double check the oil drain plug and gasket. Make certain it is present and correctly tightened in the pan.

12. Add oil to the engine.

13. Install the engine undercover.

14. Lower the vehicle to the ground. Start the engine and check for leaks.

15. Road test the vehicle and, upon returning, check for leaks. Inspect oil level and adjust if necessary.

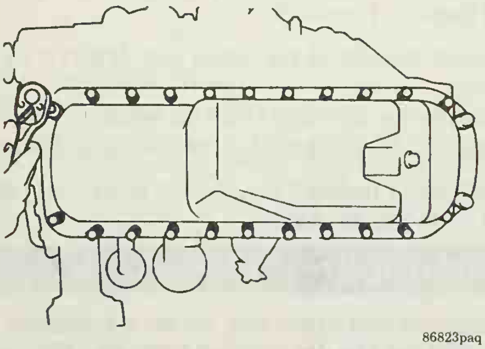


Fig. 217 On the 3F-E engine, there are 22 bolts securing the pan to the block

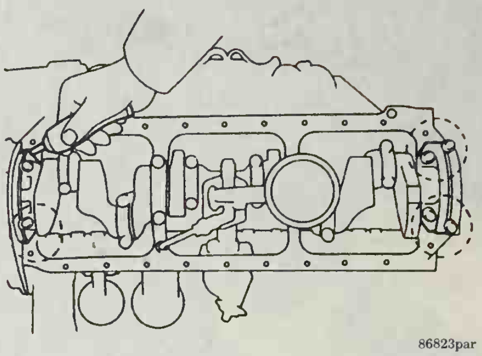


Fig. 218 Apply sealant to the 4 corners of the block

5VZ-FE Engine

➧ See Figures 219 and 220

1. Disconnect the negative battery cable.

⁂CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Remove the crankshaft timing pulley.
4. Drain the engine oil.
5. If equipped with 4WD, remove the front differential.
6. On A/T remove the oil cooler tube and clamp.
7. Remove the stiffener plate.
8. Unbolt the flywheel housing dust cover.
9. Disconnect the starter wire clamp.
10. Remove the crankshaft position sensor.
11. Unbolt and lower the oil pan.
12. Using SST 09032-00100 or equivalent and a brass bar, separate the oil pan from the cylinder block.

To install:

13. Use a razor blade or equivalent to scrape the cylinder block and oil pan mating surfaces of any old sealing material. All traces of the old gasket and sealer must be removed.

14. Clean the pan thoroughly, using solvent if necessary. If the pan has a magnet in it, examine the catchings closely; excess metal is a sign of excess engine wear. A few slivers are normal. Use good judgment in relating the amount of debris to the amount of time the pan has been in place.

15. Install the crankshaft position sensor.

16. Install the oil pan baffle plate.

17. Apply seal packing to the oil pan and install the pan to the cylinder block. Tighten the nuts and bolts to 66 inch lbs. (8 Nm). If parts are not assembled within 5 minutes of applying time, the effectiveness of the seal packing is lost and must be removed and reapplied.

18. Attach the flywheel housing under and cover dust.

19. Install the stiffener plate.

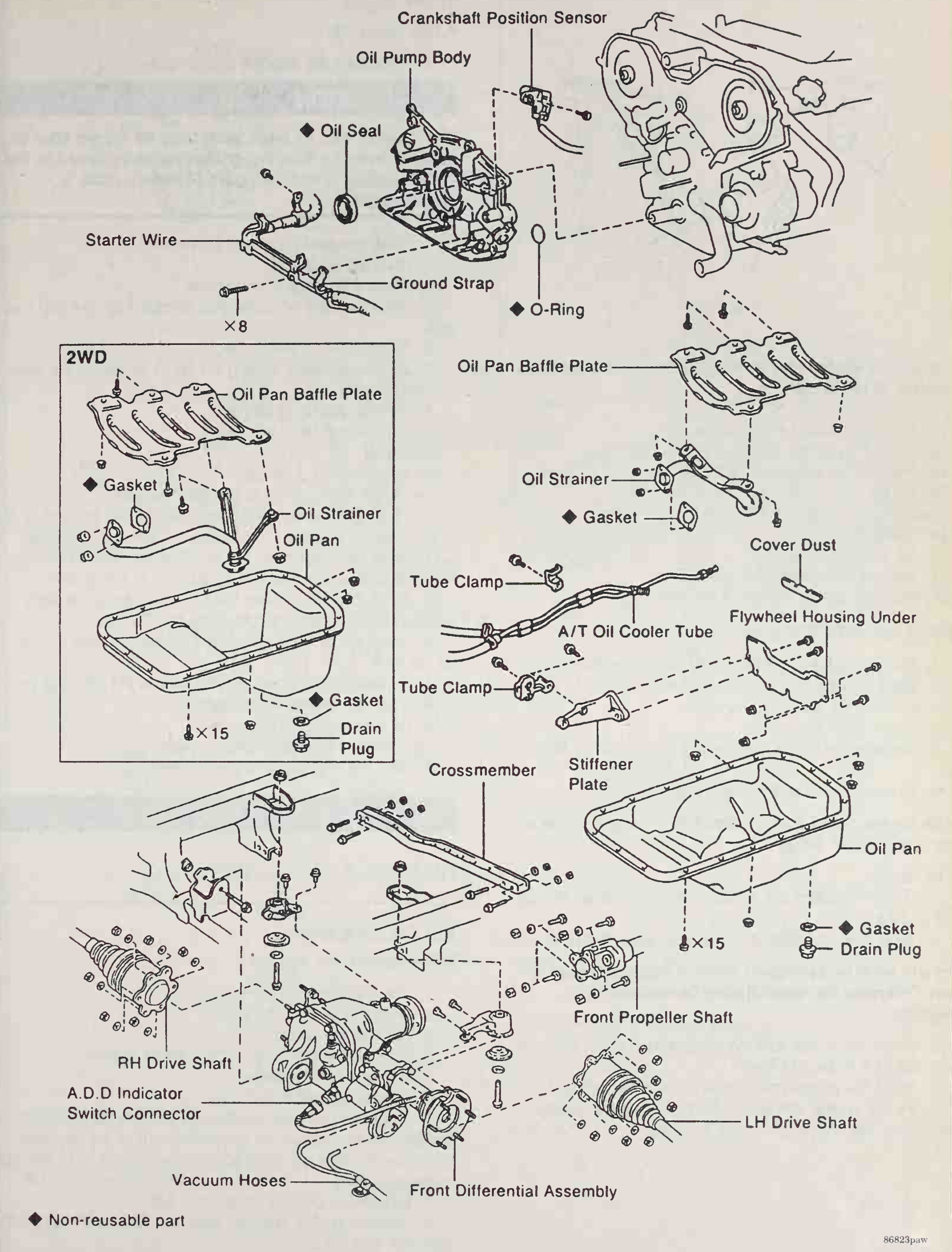

Crankshaft Position Sensor
Oil Pump Body
◆ Oil Seal
Starter Wire
Ground Strap
×8
◆ O-Ring
2WD
Oil Pan Baffle Plate
◆ Gasket
Oil Strainer
Oil Pan
◆ Gasket
×15
Drain Plug
Oil Pan Baffle Plate
Oil Strainer
◆ Gasket
Cover Dust
Tube Clamp
A/T Oil Cooler Tube
Flywheel Housing Under
Tube Clamp
Stiffener Plate
Crossmember
Oil Pan
×15
◆ Gasket
Drain Plug
Front Propeller Shaft
RH Drive Shaft
A.D.D Indicator Switch Connector
LH Drive Shaft
Vacuum Hoses
Front Differential Assembly
◆ Non-reusable part
86823paw

Fig. 219 Exploded view of the oil pan and related components on the 5VZ-FE engine

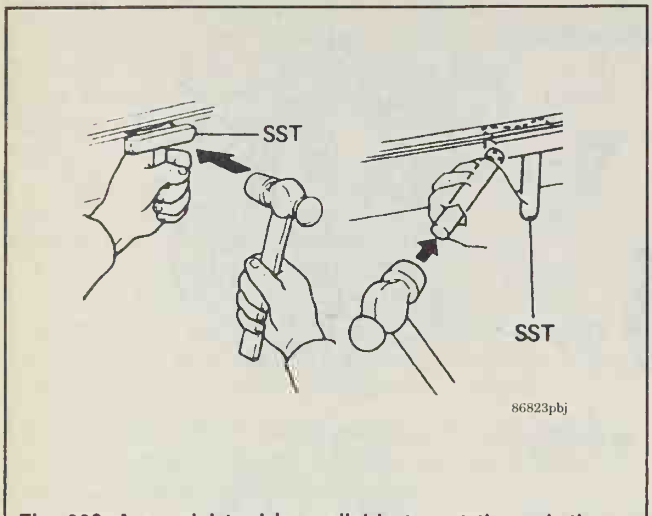


Fig. 220 A special tool is available to cut through the sealant of the oil pan

20. Connect the starter wire clamp.
21. On A/T install the oil cooler tube and clamp.
22. Reinstall the crankshaft timing pulley.
23. On the 4WD, install the front differential.
24. Install the engine under cover.
25. Lower the vehicle.
26. Fill with engine oil.
27. Connect the negative battery cable.
28. Start the engine and check for leaks.

2RZ-FE and 3RZ-FE Engines

1. Disconnect the negative battery cable from the battery.
2. Raise and support the vehicle safely.
3. Remove the engine under cover.
4. Drain the engine oil.
5. Remove the 16 mounting bolts and two nuts to the oil pan.
6. Remove the oil pan from the engine.

➡Be careful not to damage the oil pan flanges of the oil pan and cylinder block.

To install:

7. Before installing the oil pans, thoroughly clean the contact surfaces.
8. Apply sealant 08826-00080 or equivalent, to the oil pan.

➡Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.

9. Install the oil pan and mounting bolts. Tighten the bolts and nuts to 9 ft. lbs. (13 Nm).
10. Install the engine under cover. Lower the vehicle.
11. Fill the engine with oil. Connect the negative battery cable, start the engine and check for leaks.

1FZ-FE Engine

➧ See Figure 221

1. Disconnect the negative battery cable.

⁂CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Drain the engine oil.
4. Remove the engine undercover.
5. Disconnect the oil cooler pipe bracket from the No. 1 oil pan.
6. Remove the oil level sensor.
7. Remove the bolts holding the No. 1 oil pan to the transmission housing.
8. Remove the No. 2 oil pan.
9. Remove the No. 1 oil pan.

To install:

10. Install the No. 1 oil pan.
    a. Apply seal packing to the No. 1 oil pan.
    b. Install the oil pan and tighten the 14 mm bolts to 32 ft. lbs. (44 Nm) and the 12 mm bolts to 14 ft. lbs. (20 Nm).
11. Apply seal packing to the No. 2 oil pan and tighten the bolt to 6 ft. lbs. (8 Nm) and the nuts to 7 ft. lbs. (9 Nm).
12. Install the bolts holding the No. 1 oil pan to the transmission housing and tighten to 53 ft. lbs. (72 Nm).
13. Install the oil level sensor and tighten the bolts to 5 ft. lbs. (5 Nm).
14. Connect the oil cooler pipe bracket to the No. 1 oil pan.
15. Install the engine under cover.
16. Fill with engine oil.
17. Connect the negative battery cable.
18. Start the engine and check for leaks.

Oil Pump

REMOVAL & INSTALLATION

22R and 22R-E Engines

➧ See Figures 222 and 223

1. Raise and support the vehicle.
2. Drain the oil from the engine.
3. Remove the oil pan.
4. Remove the four bolts holding the oil strainer.
5. Remove the drive belts.
6. Remove the crankshaft pulley.
7. If equipped with air conditioning, remove the compressor and its bracket. Support the compressor out of the way with the hoses attached. Do not discharge the system or loosen the compressor lines.
8. Loosen the oil pump relief valve bolt.
9. Remove the five retaining bolts and remove the oil pump assembly with the O-ring.
10. Remove the oil pump drive spline from the crankshaft.

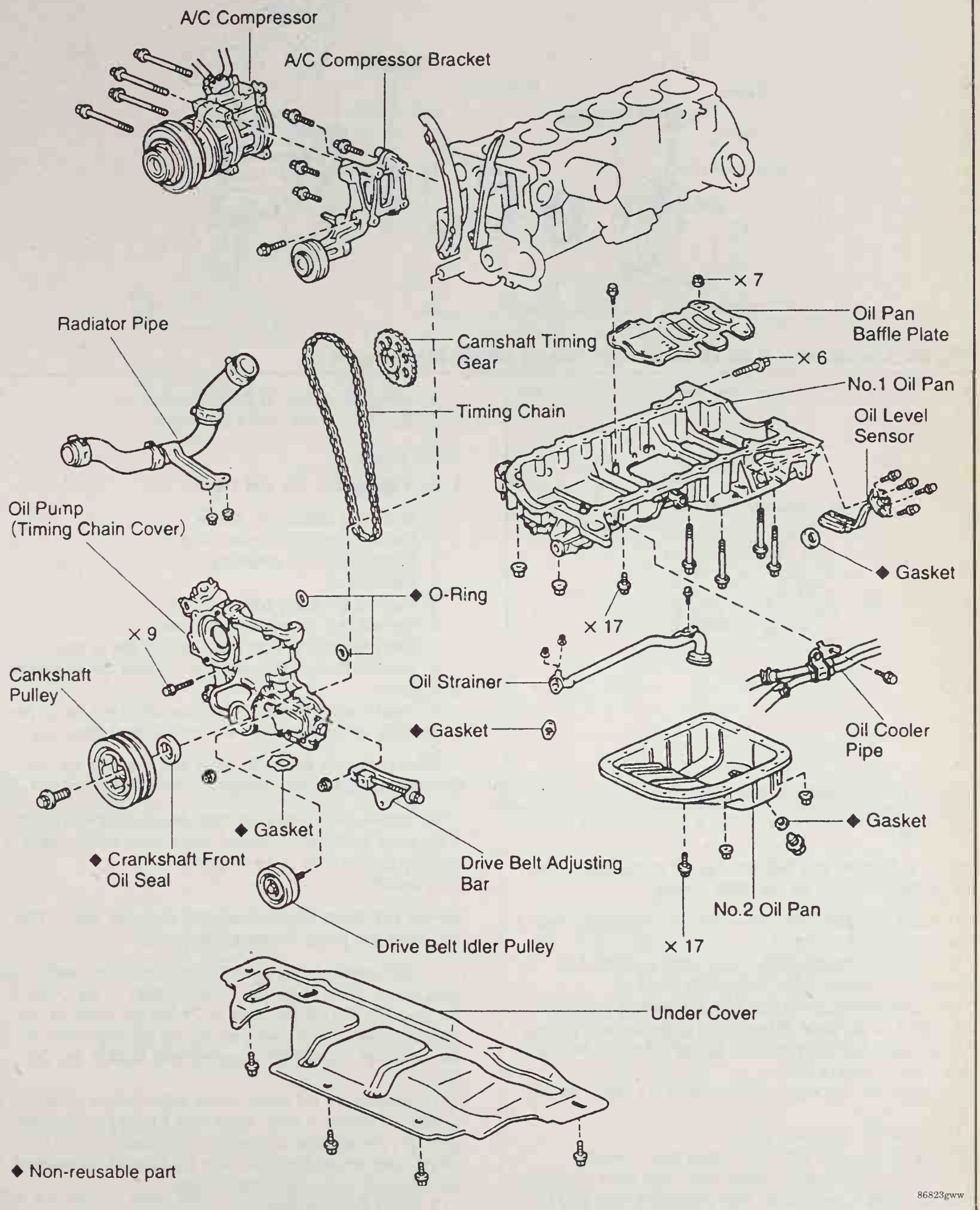

A/C Compressor
A/C Compressor Bracket
Radiator Pipe
Camshaft Timing Gear
Timing Chain
× 7
Oil Pan Baffle Plate
× 6
No.1 Oil Pan
Oil Level Sensor
Oil Pump (Timing Chain Cover)
◆ Gasket
◆ O-Ring
× 9
× 17
Cankshaft Pulley
Oil Strainer
◆ Gasket
Oil Cooler Pipe
◆ Gasket
◆ Gasket
◆ Crankshaft Front Oil Seal
Drive Belt Adjusting Bar
No.2 Oil Pan
Drive Belt Idler Pulley
× 17
Under Cover
◆ Non-reusable part
86823gww

Fig. 221 Exploded view of the oil pan and related components on the 1FZ-FE engine

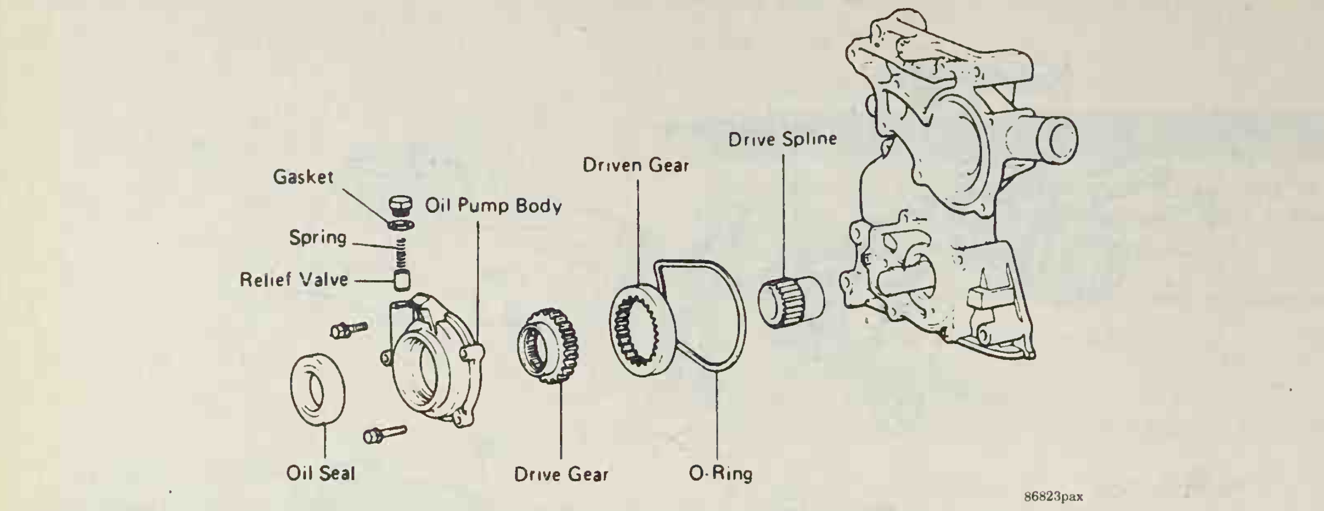


Fig. 222 Exploded view of the oil pump components on 22R and 22R-E engines

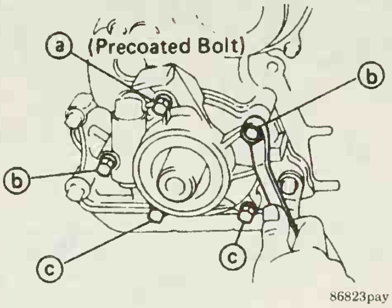


Fig. 223 Bolt location identification

To install:

➡Pack petroleum jelly between the oil pump gears. This will prime the pump during initial startup.

11. Slide the pump drive spline onto the crankshaft. Place a new O-ring in the groove.
12. Clean the threads of the upper retaining bolt of all grease, oil or debris. Clean all the bolts holes.
13. Apply sealant to the first 2 or 3 threads of the upper bolt. Install all the bolts. Tighten each to the correct tightness. Bolt (a): 18 ft. lbs. (25 Nm); bolts (b) 14 ft. lbs. (19 Nm) and bolts (c) 9 ft. lbs. (13 Nm).
14. Install and tighten the relief valve plug to 27 ft. lbs. (37 Nm).
15. Install the crankshaft pulley.
16. Install the drive belts, then adjust them correctly.
17. Install the oil strainer. Make sure it has been thoroughly cleaned. Install a new gasket, then tighten the bolts to 9 ft. lbs. (13 Nm).
18. Install the oil pan.
19. Lower the vehicle, fill the engine with oil.
20. Start then engine, check for leaks.

3VZ-E Engine

➧ See Figures 224, 225 and 226

1. Raise and support the vehicle.
2. Remove the engine under cover.
3. Remove the front differential.
4. Drain the oil.
5. Remove the timing belt.
6. Remove the crankshaft timing pulley.
7. Raise the engine slightly and remove the oil pan.
8. Remove the two bolts and nuts; remove the oil strainer and gasket.
9. Insert a drift between the cylinder block and the oil pan baffle plate, cut off the sealer and remove the baffle plate.

➡When removing the baffle plate with the drift, do not damage the baffle plate flange.

10. Remove the seven bolts, then the oil pump and O-ring. If the pump is difficult to remove, use a small plastic mallet to carefully tap the body of the oil pump.

To install:

➡Pack petroleum jelly between the oil pump gears. This will prime the pump during initial startup.

11. Apply sealer to the oil pump mating surface, running the bead on the inside of the bolt holes. Position a new O-ring in the groove in the cylinder block and install the pump so that the spline teeth of the drive gear engage the large teeth on the crankshaft. Tighten the mounting bolts to 14 ft. lbs. (20 Nm).
12. Remove any old sealer on the baffle plate and block surfaces. If solvent is used, make sure it does not affect the paint. Dry the surfaces completely. Apply sealant in a 0.1 in. (3mm) bead around the baffle. Run the bead to the inside of the bolt holes and avoid excess sealant.
13. Install the baffle plate.
14. Install the oil strainer and tighten the bolts to 61 inch lbs. (7 Nm).
15. Install the oil pan.

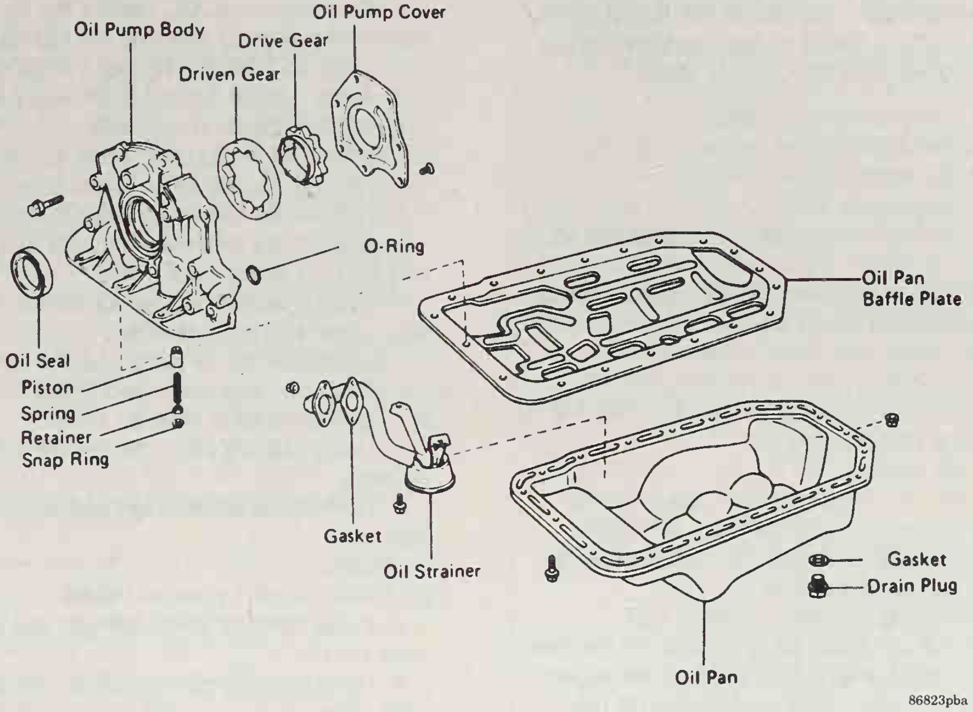

Oil Pump Cover
Oil Pump Body
Drive Gear
Driven Gear
O-Ring
Oil Pan
Baffle Plate
Oil Seal
Piston
Spring
Retainer
Snap Ring
Gasket
Oil Strainer
Gasket
Drain Plug
Oil Pan
86823pba

Fig. 224 Exploded view of the oil pump components on the 3VZ-E engine

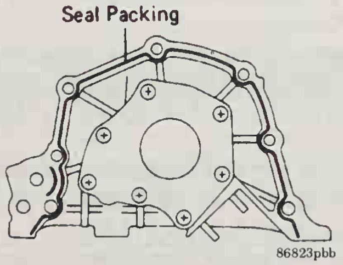

Seal Packing
86823pbb

Fig. 225 Do not apply too much sealant on the pump surface, it can block the oil passage

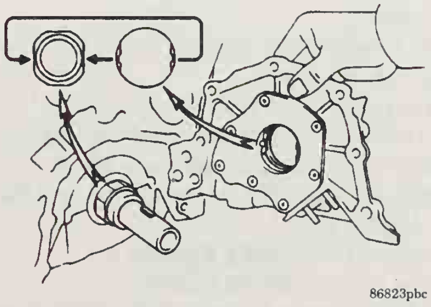


Fig. 226 Align the pump drive and the pump

16. Install the crankshaft pulley.
17. Install the timing belt.
18. Install the front differential and the undercover.
19. Lower the vehicle.
20. Fill the engine with oil and check for leaks.

2RZ-FE and 3RZ-FE Engines

➡The oil pump assembly is mounted in the timing chain cover. To properly service the oil pump, the timing chain cover must be removed from the cylinder block.

1. Disconnect the negative battery cable.
2. Drain the engine oil and cooling system.
3. Raise and safely support the vehicle.
4. Remove the engine under cover.
5. If equipped with 4WD, remove the front differential and halfshaft assembly.
6. For the California vehicles with 3RZ-FE engine, remove the two bolts and disconnect the air pipe.
7. Disconnect the upper hose from the radiator.
8. Remove the oil dipstick guide by removing the bolt.
9. If equipped with power steering, remove the drive belt by loosening the lock bolt and adjusting bolt.
10. Remove the fan shrouds.
11. If equipped with A/C, loosen the idler pulley nut and adjusting bolt, then remove the drive belt from the engine.
12. Remove the alternator drive belt, fan (with fan clutch), water pump pulley, and the fan shroud:
    a. Loosen the water pump pulley mounting nuts.
    b. Loosen the lock, pivot and adjusting bolts for the alternator and remove the alternator drive belt from the engine.
    c. Remove the four water pump pulley mounting nuts.
    d. Remove the fan (with fan clutch) and the water pump pulley.
13. Remove the cylinder head from the engine.
14. If equipped with A/C, disconnect the compressor and bracket:
    a. Remove the four mounting bolts and disconnect the compressor from the bracket. Do not disconnect the A/C pressure lines from the compressor. Suspend the compressor away from the engine.
    b. Remove the A/C compressor bracket by removing the four bolts.
15. Remove the alternator, adjusting bar and bracket:
    a. Loosen the lock bolt, pivot bolt, nut and adjusting bolt at the alternator.
    b. After loosening the adjusting bolt, remove the alternator drive belt from the engine.
    c. Disconnect the alternator wiring.
    d. Remove the nut, then disconnect the alternator wire.
    e. Disconnect the wire harness with the clip.
    f. Remove the lock bolt, pivot bolt, nut, and the alternator from the engine.
    g. Unbolt and remove the adjusting bar.
    h. Unbolt and remove the bracket.
16. Unbolt and remove the crankshaft position sensor.
17. If equipped with 2WD, remove the stiffener plates by removing the eight bolts.
18. Remove the flywheel housing undercover and dust seal.
19. Remove the oil pan by removing the 16 mounting bolts and 2 nuts.

➡Be careful not to damage the flanges of the oil pan and cylinder block.

20. Remove the two bolts, two nuts, oil strainer, and gasket.
21. Remove the crankshaft pulley:
    a. If equipped with A/C, remove the No. 2 and No. 3 crankshaft pulleys by removing the four bolts.
    b. Using SST 09213-54015 and 09330-00021 or equivalents, remove the crankshaft pulley bolts.
    c. Remove the crankshaft pulley.
22. Remove the timing chain cover as follows:
    a. Remove the two water bypass pipe mounting nuts.
    b. Remove the two timing chain cover mounting bolts.
    c. Remove the nine mounting bolts and two mounting nuts from the timing chain cover.
    d. Using a rubber hammer, loosen the chain cover, timing chain cover and three gaskets.
23. Disassemble the oil pump from the front cover, pump cover, drive rotor, driven rotor and O-ring.
24. Remove the relief valve as follows:
    a. Using snapring pliers, remove the snapring for the relief valve.
    b. Remove the retainer, spring(s) and relief valve from the front cover.

To install:

25. Install the relief valve as follows:
    a. Install the relief valve, spring(s) and retainer to the valve cover.
    b. Using snapring pliers, install the snapring to hold the relief valve.

➡Pack petroleum jelly between the oil pump gears. This will prime the pump during initial startup.

26. Install the drive and driven rotors as follows:
    a. Place the drive and driven rotors into the pump body.
    b. Place a new O-ring to the pump body.
    c. Install the pump cover with the nine screws.
27. Install the timing chain cover.
28. Install the 2 rear timing chain cover mounting bolts and water bypass pipe mounting nuts. Tighten to 13 ft. lbs. (18 Nm).
29. Align the pulley set key with the key groove of the pulley and slide on the pulley. Install and tighten the pulley bolt to 193 ft. lbs. (260 Nm).
30. If equipped with A/C, install the crankshaft pulleys with the four bolts. Tighten the bolts to 18 ft. lbs. (25 Nm).
31. Install the oil strainer, then tighten the fasteners to 13 ft. lbs. (18 Nm).
32. Clean the oil pan and cylinder block mating surfaces. Apply seal packing to the oil pan. Install the oil pan and tighten the fasteners to 9 ft. lbs. (13 Nm).
33. Install the flywheel housing undercover and dust seal.
34. If equipped with 2WD, install the stiffener plates. Tighten the eight bolts to 27 ft. lbs. (37 Nm).
35. Using a new O-ring, install the crankshaft position sensor, tighten to 74 inch lbs. (9 Nm).
36. Install the alternator to the engine as follows:
    a. Attach the alternator to the engine, then install the nut, pivot bolt, and the lock bolt. Do not tighten the bolts or nut at this time.

b. Connect the wire harness with the clip to the alternator.

c. Install the alternator wire with the nut.

d. Connect the alternator harness.

e. Install the drive belt to the engine.

f. Tighten the drive belt with the adjusting bolt. Belt tension should be as follows:

- New belt: 155-175 lbs.
- Old belt: 75-125 lbs.

g. Once the belt is tight, tighten the pivot bolt to 43 ft. lbs. (59 Nm); lock bolt to 21 ft. lbs. (29 Nm).

37. If equipped with A/C, install the compressor as follows:

a. Install the A/C compressor bracket with the four bolts, tighten to 32 ft. lbs. (44 Nm).

b. Connect the A/C compressor to the bracket with the four bolts, tighten to 18 ft. lbs. (25 Nm).

38. Install the cylinder head.

39. Install the water pump pulley, fan shroud, fan (with fan clutch), and the alternator drive belt as follows:

a. Place the fan (with the fan clutch), water pump pulley and fan shroud in position.

b. Install the water pump pulley mounting nuts but do not tighten the nuts at this time.

c. Install the alternator drive belt to the engine.

d. Stretch the alternator belt tight, then tighten the fan nuts to 16 ft. lbs. (21 Nm).

e. Adjust the drive belt for the alternator.

40. Install the fan shrouds.
41. Install and adjust the power steering drive belt.
42. Install the oil dipstick guide with the bolt.
43. Connect the upper hose to the radiator.
44. If removed, attach the air pipe.
45. If equipped with 4WD, install the front differential and halfshaft assembly.
46. Install the engine under cover.
47. Lower the vehicle.
48. Fill the cooling system and engine oil.
49. Connect the negative battery cable.
50. Start the engine and check for leaks.
51. Recheck and top off all fluid levels.
52. Adjust ignition timing. Road test the vehicle for proper operation.

5VZ-FE Engine

See Figures 227, 228, 229, 230, 231, 232 and 233

1. Disconnect the negative battery cable.

CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Remove the crankshaft timing pulley.
4. Drain the engine oil.
5. If equipped with 4WD, remove the front differential.
6. On A/T remove the oil cooler tube and clamp.
7. Remove the stiffener plate.
8. Unbolt the flywheel housing dust cover.
9. Disconnect the starter wire clamp.
10. Remove the crankshaft position sensor.
11. Unbolt and lower the oil pan.
12. Remove the oil strainer and gasket.
13. Unbolt the oil pan baffle plate.
14. Remove the 8 bolts, ground strap and oil pump from the engine. Using a plastic head hammer, carefully tap the pump body. Remove the O-ring from the block.

To install:

15. Use a razor blade or equivalent to scrape the cylinder block and oil pan mating surfaces of any old sealing material. All traces of the old gasket and sealer must be removed.
16. Clean the pan thoroughly, using solvent if necessary. If the pan has a magnet in it, examine the catchings closely; excess metal is a sign of excess engine wear. A few slivers are normal. Use good judgment in relating the amount of debris to the amount of time the pan has been in place.
17. Apply multi-purpose grease to the oil seal lip. Using a special service tool 09306-37010 or equivalent, along with a

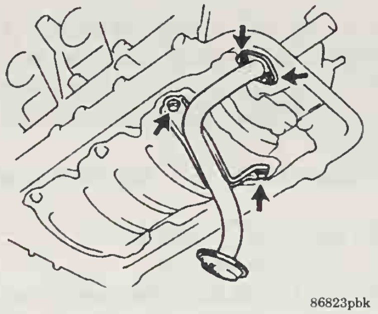


Fig. 227 Remove the bolts securing the oil strainer

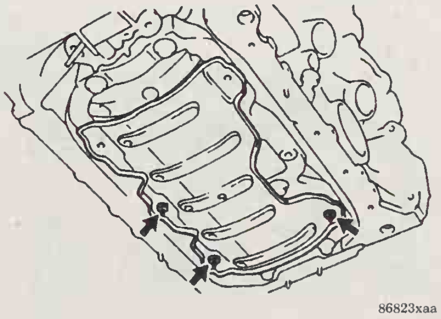


Fig. 228 Remove the three bolts retaining the oil pan baffle

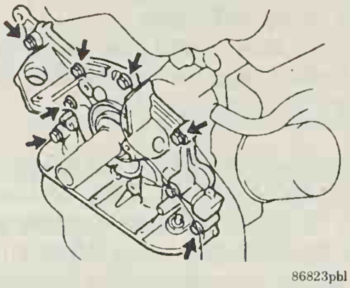


Fig. 229 Remove the bolts securing the oil pump body to the engine

hammer, tap in the oil seal until it's surface is flush with the pump body edge.

➡Pack petroleum jelly between the oil pump gears. This will prime the pump during initial startup.

18. Remove any old sealant from the surface of the pump, apply new sealant to the oil pump, place the new O-ring into the groove of the block. Place the pump on the crankshaft with the spline teeth of the drive rotor engaged with the large teeth of the crankshaft.
19. Tighten fasteners A to 15 ft. lbs. (20 Nm) and B to 31 ft. lbs. (42 Nm).
20. Install the crankshaft position sensor.
21. Install the oil pan baffle plate.
22. Apply seal packing to the oil pan and install the pan to the cylinder block. Tighten the nuts and bolts to 66 inch lbs. (8 Nm). If parts are not assembled within 5 minutes of applying time, the effectiveness of the seal packing is lost and must be removed and reapplied.
23. Attach the flywheel housing under and cover dust.
24. Install the stiffener plate.

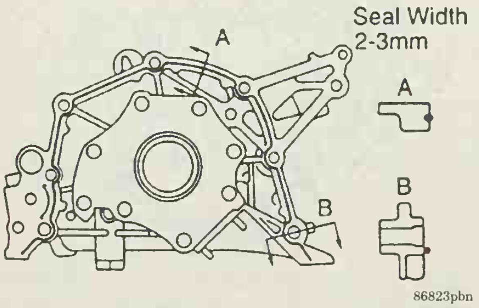


Fig. 230 Place a bead of sealant as shown

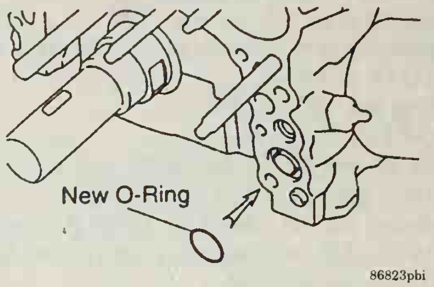


Fig. 231 Place the new O-ring into the groove of the block

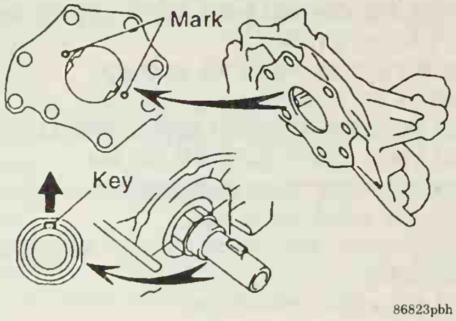


Fig. 232 Place the pump on the crankshaft as shown

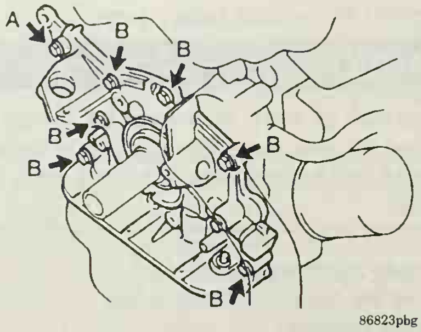


Fig. 233 A and B bolt locations

25. Connect the starter wire clamp.
26. On A/T install the oil cooler tube and clamp.
27. Reinstall the crankshaft timing pulley.
28. On the 4WD, install the front differential.
29. Install the engine under cover.
30. Lower the vehicle.
31. Fill with engine oil.
32. Connect the negative battery cable.
33. Start the engine and check for leaks.

3F-E Engines

➧ See Figures 234, 235 and 236

1. Raise and support the vehicle.
2. Remove the oil pan.
3. Remove the oil outlet pipe.
4. Remove the oil pump retaining bolt(s) and nuts; remove the strainer and gasket.
5. Remove the retaining bolt and remove the oil pump.
6. Remove the oil pump cover and inspect the parts for nicks, scoring, grooving, etc.

To install:

➡Pack petroleum jelly between the oil pump gears. This will prime the pump during initial startup.

7. Install the oil pump so that the slot in the oil pump shaft is in alignment with the protrusion on the governor shaft of the distributor. Tighten the mounting bolts just snug.
8. Use new gaskets. Install the outlet pipe and strainer, again tightening the bolts just snug.
9. Tighten the nuts and bolts in the order shown. When tightening the oil strainer nuts (4) press the strainer onto the cylinder block so there is no gap between the strainer and block. Use the illustration and tighten the nuts and bolts: (1) and (2), 33 ft. lbs. (44 Nm); (3), 13 ft. lbs. (18 Nm); (4), 10 ft. lbs. (13 Nm) and (5), 13 ft. lbs. (18 Nm).
10. Install the oil pan.
11. Lower the vehicle, fill the engine with oil and check for leaks.

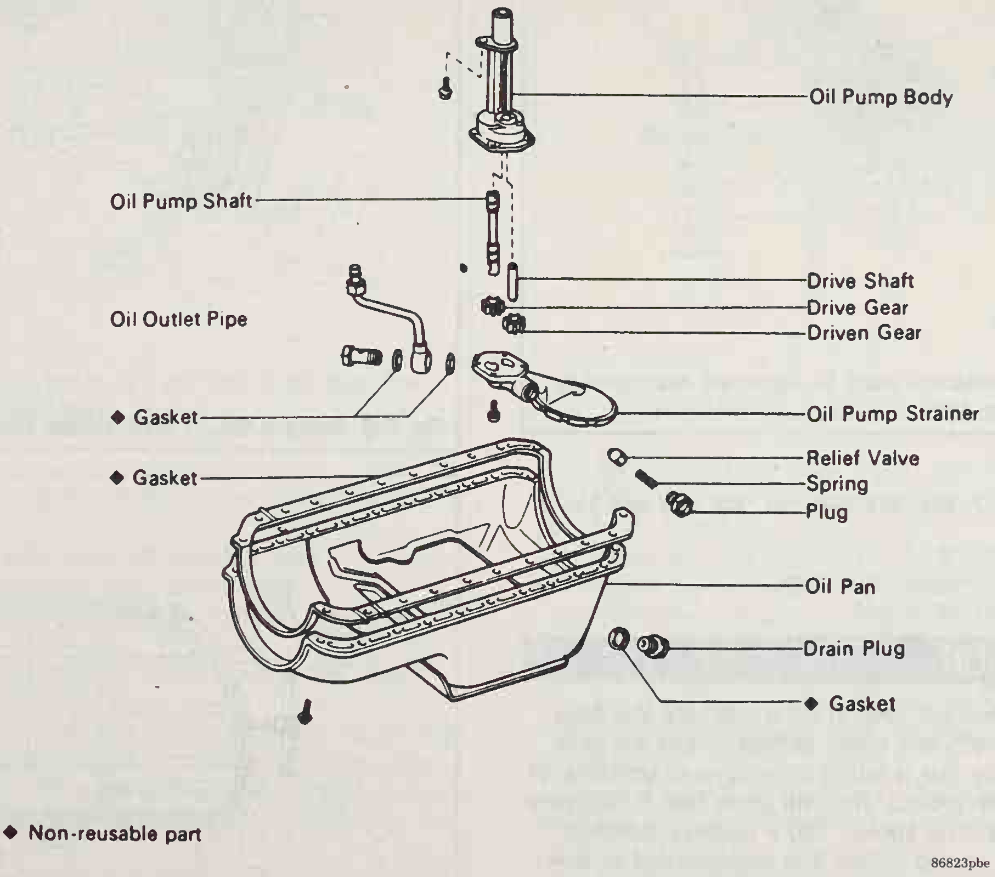

Oil Pump Body
Oil Pump Shaft
Drive Shaft
Drive Gear
Driven Gear
Oil Outlet Pipe
◆ Gasket
Oil Pump Strainer
◆ Gasket
Relief Valve
Spring
Plug
Oil Pan
Drain Plug
◆ Gasket
◆ Non-reusable part
86823pbe

Fig. 234 Exploded view of the components for the oil pump on the 3F-E engine

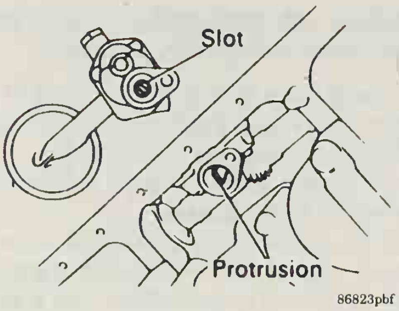


Fig. 235 Insert the slot of the drive into the protrusion of the block

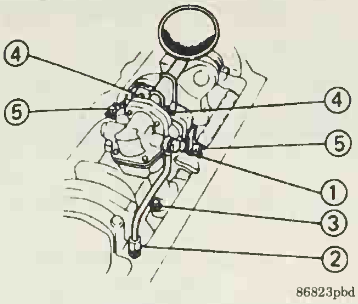


Fig. 236 The fasteners must be tightened appropriately in the correct order

1FZ-FE Engine

See Figures 237, 238, 239, 240, 241, 242, 243 and 244

1. Drain the engine oil.
2. Remove the engine under cover.
3. Drain the engine coolant.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

4. Remove the radiator.
5. Disconnect the A/C compressor and bracket. Loosen the pulley nut and adjusting bolt, then remove the belt. Put the compressor aside but do not disconnect any of the lines.
6. Disconnect the radiator hose from the inlet, then unbolt and remove the radiator pipe.
7. Remove the water pump.
8. Remove the cylinder head.
9. Disconnect the oil cooler bracket from the No. 1 oil pan.
10. Remove the oil level sensor and gasket.
11. Unbolt the No. 1 oil pan to the transmission housing.
12. Remove the No. 2 oil pan, this is the pan with 17 mounting bolts. Insert a blade or SST 09032-00100, between the No. 1 and No. 2 oil pans, remove the sealer and lower the No. 2 pan.
13. Remove the 21 bolts retaining the No. 1 oil pan. Pry portions A between the block and the No. 1 pan.
14. Remove the oil pan baffle plate.
15. Remove the oil strainer.
16. Unbolt the crankshaft pulley, then remove the drive belt idler pulley.
17. Unbolt the oil pump (timing chain cover), timing chain and camshaft gear.

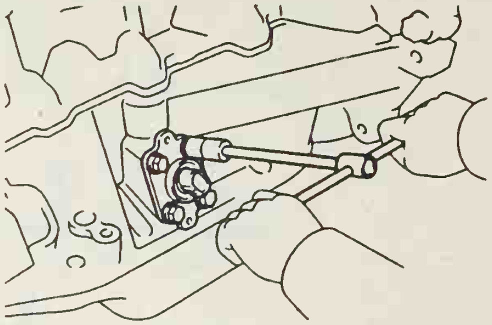


Fig. 237 Remove the oil level sensor and gasket

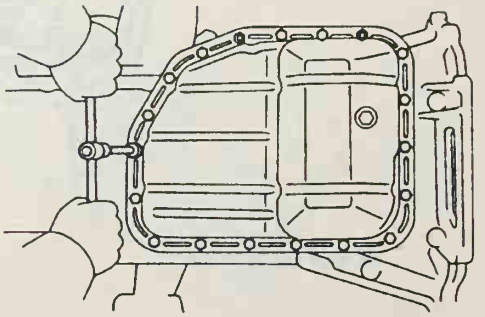


Fig. 238 Remove the bolts securing the No. 2 oil pan

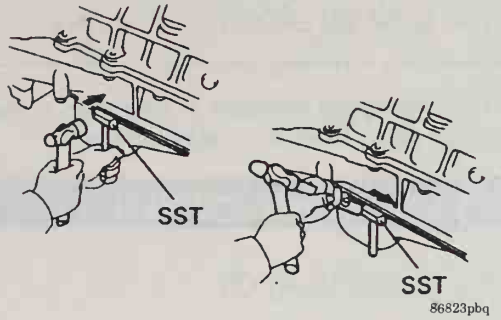


Fig. 239 A special tool is available to cut through the sealant of the oil pan

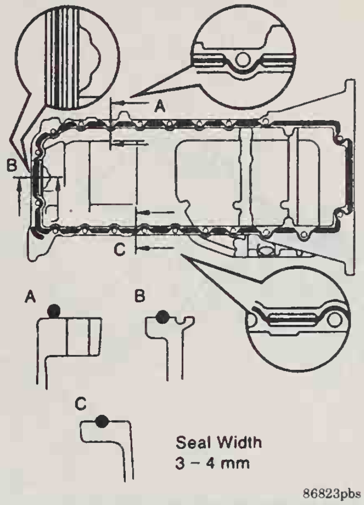


Fig. 241 Apply sealant to the areas shown

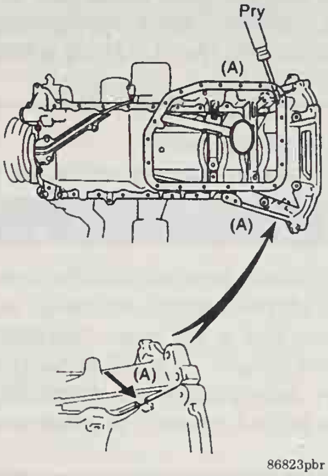


Fig. 240 Use a prybar to pry portions A between the block and the No. 1 pan

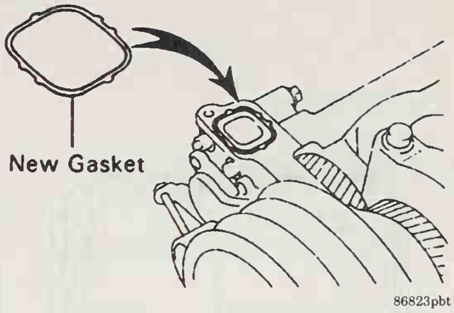


Fig. 242 Install the new gasket to the engine

To install:

18. Turn the crankshaft until the set key on the crankshaft faces downwards.
19. Install the timing chain and camshaft gear.
20. Attach the oil pump (timing chain cover).
21. Install the drive belt idler pulley then the crankshaft pulley.
22. Install the oil strainer to the block with a new gasket, tighten to 14 ft. lbs. (20 Nm).
23. Install the oil baffle plate, tighten to 78 inch lbs. (9 Nm).
24. Remove any old sealant from the No. 1 oil pan. Clean all the components with a non-residue solvent. Apply sealant to the No. 1 pan as shown. Install the pan within 5 minutes of application.
25. Install a new gasket into position. Pour approximately 0.9 cu. in. 15 cm_3 of engine oil into the oil pump hole. Install the No. 1 pan, tighten the 14mm heads to 31 ft. lbs. (44 Nm) and the 12mm heads to 14 ft. lbs. (20 Nm).
26. Apply sealant to the No. 2 pan, assemble within 5 minutes. Tighten the bolts to 69 inch lbs. (8 Nm) and the nuts to 78 inch lbs. (9 Nm).
27. Attach the bolts retaining the No. 1 pan to the transmission housing, tighten to 53 ft. lbs. (73 Nm).
28. Install the oil level sensor, tighten to 48 inch lbs. (5 Nm).
29. Connect the oil cooler pipe bracket to the No. 1 pan.
30. Install the cylinder head using a new gasket.
31. Install the water pump with new gaskets on the engine.
32. Connect the radiator hose to the inlet, tighten to 15 ft. lbs. (21 Nm).
33. Install the A/C compressor and bracket, tighten the bracket to 27 ft. lbs. (37 Nm) and the compressor to 18 ft. lbs. (25 Nm).
34. Install the radiator.
35. Attach the engine under cover.
36. Lower the vehicle, fill the engine with oil and coolant.
37. Start the engine and check for leaks. Top off any fluid levels.

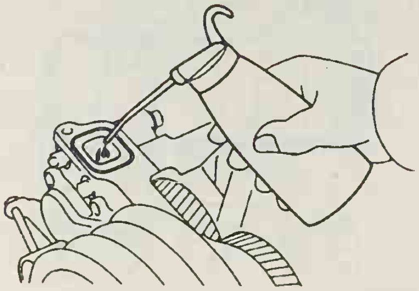


Fig. 243 Add only the amount specified to the oil pump hole

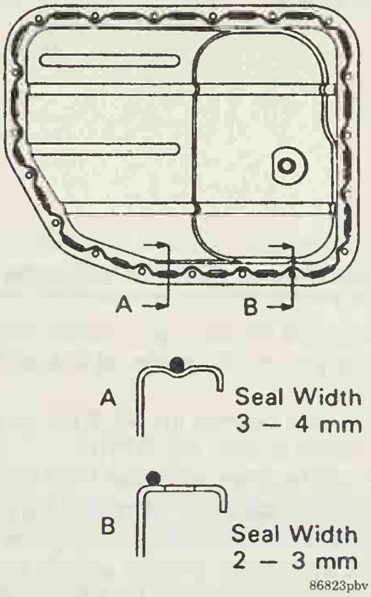


Fig. 244 Apply sealant to the No. 2 pan as shown

Timing Belt Cover and Seal

REMOVAL & INSTALLATION

Refer to the timing belt procedure in this section to remove the timing belt cover. There is no replaceable seal.

Timing Chain Cover and Seal

REMOVAL & INSTALLATION

22R and 22R-E Engines

➧ See Figure 245

✲✲WARNING

This procedure requires tools which may not be in your tool box. Pulley extractors and a counter-holding bar are required. Do not attempt the procedure without these tools available.

1. Remove the cylinder head.
2. Drain the cooling system and remove the radiator.

✲✲CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. On 4WD vehicles, remove the front differential.
4. Remove the oil pan.
5. Remove the power steering belt if so equipped.
6. Remove the air conditioning belt, compressor and bracket if so equipped.
7. Remove the fan clutch (fluid coupling), with the fan and water pump pulley.
8. Matchmark and remove the crankshaft pulley(s). This bolt will be very tight. Use the counter-holding bar, properly installed, to hold the crankshaft while loosening the bolt. Use the pulley extractor or gear puller to remove the pulley from the shaft.
9. Remove the water bypass pipe.
10. Remove the fan belt adjusting bar. If necessary, remove the lower power steering bracket for access.
11. Disconnect the heater water outlet pipe.
12. Unbolt the timing chain cover assembly. Be careful to loosen only the correct bolts.

To install:

13. Install new gaskets over the dowels on the timing chain cover. Slide the cover assembly over the dowels and pump spline. Insert the retaining bolts and tighten them. Tighten the 8mm bolts to 9 ft. lbs. (13 Nm) and the 10mm bolts to 29 ft. lbs. (39 Nm).

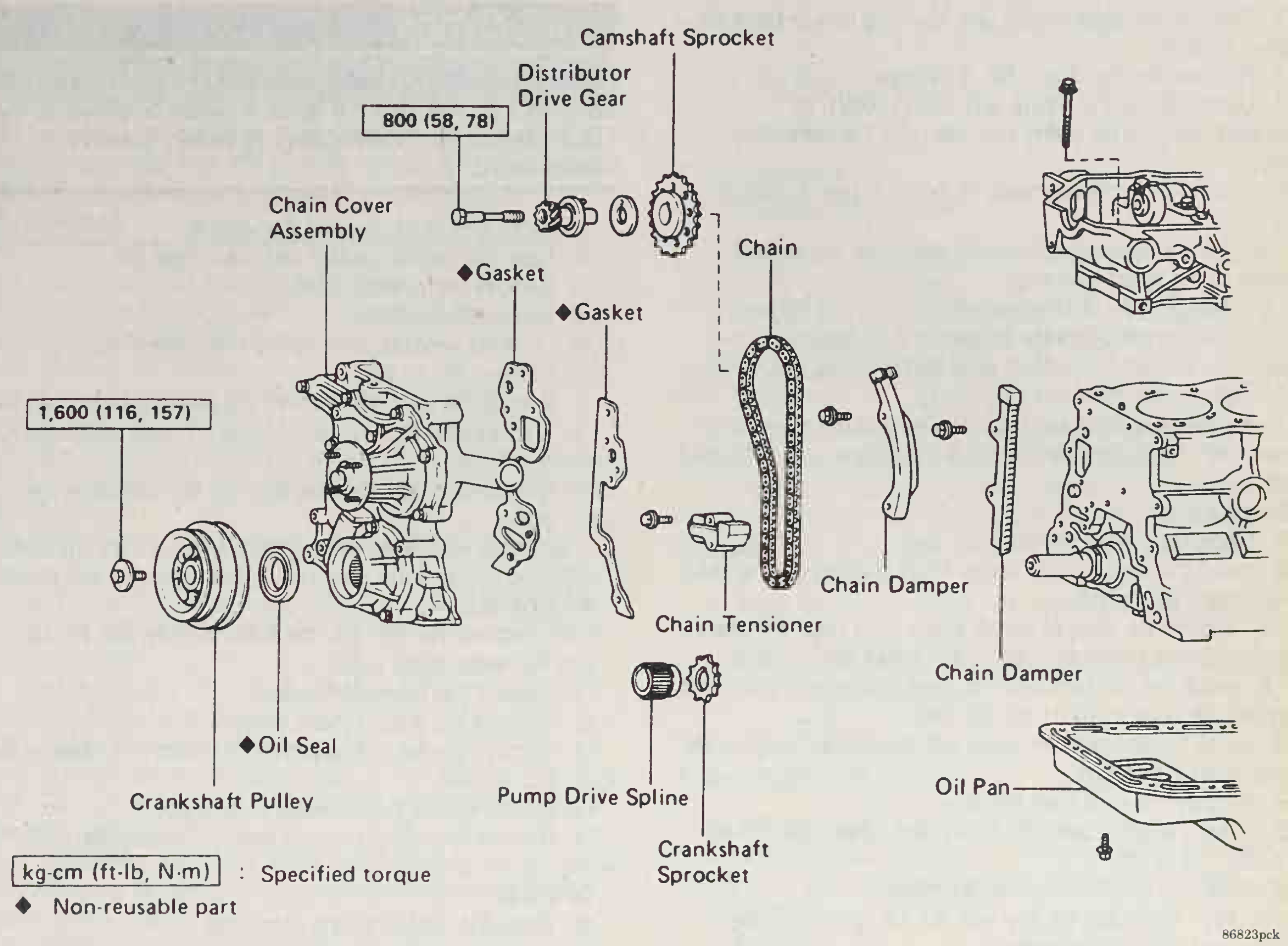

Camshaft Sprocket
Distributor Drive Gear
800 (58, 78)
Chain Cover Assembly
◆Gasket
◆Gasket
Chain
1,600 (116, 157)
Chain Damper
Chain Tensioner
Chain Damper
◆Oil Seal
Crankshaft Pulley
Pump Drive Spline
Oil Pan
Crankshaft Sprocket
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86823pck

Fig. 245 Exploded view of the timing chain and cover on the 22R and 22R-E engines

14. Temporarily install the adjusting bar to the alternator. Install the adjusting bar to the chain cover and tighten the bolts to 9 ft. lbs. (13 Nm).
15. Install the heater water outlet pipe.
16. Install the water bypass pipe.
17. Install the crankshaft pulley and bolt. Use the counter-holding tool to hold the pulley and tighten the bolt to 116 ft. lbs. (157 Nm). If equipped with air conditioning, install the second crankshaft pulley.
18. Install the water pump pulley and fluid coupling with the fan.
19. Adjust the tension on the drive belts.
20. Install the air conditioning compressor bracket, compressor and belt if they were removed.
21. Install the power steering belt and adjust it.
22. Attach the oil pan.
23. Install the radiator.
24. Install the front differential.
25. Install the cylinder head.

1FZ-FE Engine

1. Disconnect the negative battery cable.

⁂CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Drain the engine oil and the engine coolant.
4. Remove the engine under cover.
5. Remove the radiator.
6. Disconnect and remove the A/C compressor and the bracket.
7. Remove the radiator pipe by disconnecting the radiator hose from the water inlet.
8. Remove the water pump and the gasket.
9. Remove the cylinder head.

10. Disconnect the oil cooler pipe bracket from the No. 1 oil pan.
11. Remove the oil level sensor.
12. Remove the bolts holding the No. 1 oil pan to the transmission housing.
13. Remove the No. 2 and No. 1 oil pans.
14. Using SST 09213-58012 and 09330-00021, or equivalent, remove the pulley bolt. Remove the crankshaft pulley.
15. Check the thrust clearance of the oil pump driveshaft gear.
    a. Using a dial indicator with a lever type attachment, measure the thrust clearance.
    b. Maximum thrust clearance is 0.0118 in. (0.30 mm).
    c. If the thrust clearance is greater than maximum, replace the oil pump driveshaft gear and/or timing chain cover.
16. Remove the drive belt idler pulley.
17. Remove the bolts securing the timing chain cover, then remove the cover. Be sure to note the locations of the different sized bolts.

To install:

18. Clean the gasket mating areas well.
19. Install the timing chain cover. Apply packing seal to the cover before installation.
    a. Engage the gear of the oil pump drive rotor with the gear of the oil pump drive gear, and install the oil pump.
    b. Install the oil pump and the drive belt adjusting bar and tighten the bolts to 15 ft. lbs. (21 Nm).
20. Install the timing chain cover with the proper length bolts in their correct locations.
21. Remove the cord from the chain.
22. Install the drive belt idler pulley and tighten the bolt to 32 ft. lbs. (43 Nm).
23. Install the crankshaft pulley as follows:
    a. Align the pulley set key with the key groove of the pulley and slide on the pulley.
    b. Install the pulley bolt and tighten to 304 ft. lbs. (412 Nm).
24. Install the No. 1 and the No. 2 oil pans.
25. Install the bolts holding the No. 1 oil pan to the transmission housing. Tighten to 53 ft. lbs. (72 Nm).
26. Install the oil level sensor with a new gasket and tighten the bolts to 48 inch lbs. (5 Nm).
27. Connect the oil cooler pipe bracket to the No. 1 oil pan.
28. Install the cylinder head.
29. Install the water pump and tighten the bolts to 15 ft. lbs. (21 Nm).
30. Attach the No. 2 radiator hose to the water inlet. Install the nuts holding the radiator pipe to the No. 1 oil pan, then tighten to 15 ft. lbs. (21 Nm).
31. Install the A/C compressor bracket, tighten the bolts to 27 ft. lbs. (37 Nm).
32. Install the A/C compressor, tighten the bolts to 18 ft. lbs. (25 Nm). Install and adjust the drive belt.
33. Install the radiator.
34. Refill the engine oil and the engine coolant.
35. Connect the negative battery cable.
36. Start the engine, check for leaks, and check the ignition timing.
37. Install the engine under cover.
38. Top off any fluid levels.

2VZ-FE Engine

1. Disconnect the negative battery cable.

✲✲CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Drain the engine coolant and the engine oil.
4. Remove the cylinder head.
5. Remove the radiator.
6. On 4WD vehicles, remove the front differential.
7. Remove the oil pan.
8. If equipped with P/S, remove the power steering belt.
9. If equipped with A/C, remove the A/C belt, compressor, and the bracket.
10. Remove the fluid coupling with the fan and the water pump pulley.
    a. Loosen the water pump pulley bolts. Loosen the belt adjusting bolt and the pivot bolt of the alternator and remove the drive belt.
    b. Remove the set nuts, the fluid coupling with the fan, and the water pump pulley.
11. Remove the crankshaft pulley.
12. Remove the water bypass pipe.
13. Remove the fan belt adjusting bar. With P/S, remove the lower P/S bracket.
14. Disconnect the heater water outlet pipe.
15. Remove the chain cover assembly. Remove the bolts shown by the arrows.

To install:

16. Clean the gasket mating areas well.
17. Install the timing chain cover assembly.
    a. Remove the old cover gaskets and install new gaskets.
    b. Slide the cover assembly over the dowels and the pump spline. Tighten the 8 mm bolts to 9 ft. lbs. (13 Nm) and the 10 mm bolts to 29 ft. lbs. (13 Nm).
18. Install the fan belt adjusting bar to the chain cover and the cylinder head. Tighten to 9 ft. lbs. (13 Nm).
19. Install the heater water outlet pipe.
20. Install the water bypass pipe.
21. Install the crankshaft pulley and tighten the bolt to 116 ft. lbs. (157 Nm).
22. Install the water pump pulley and the fluid coupling with the fan. Place the belt onto each pulley. While pulling the belt tight, tighten the four nuts.
23. Adjust the drive belt tension.
24. If removed, install the A/C compressor bracket, the compressor and the belt.
25. If removed, install the P/S belt.
26. Apply seal packing to the joint part of the cylinder block, the chain cover, the cylinder block, the rear oil seal retainer and the oil pan. Install the oil pan over the studs on the block and tighten the nuts and bolts to 9 ft. lbs. (13 Nm).
27. Install the radiator.
28. Install the cylinder head.
29. If removed, install the front differential.
30. Fill with engine coolant and engine oil.
31. Connect the negative battery cable.

32. Start the engine and check the ignition timing.

3RZ-FE Engine

1. Disconnect the negative battery cable.

✱✱CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Drain the engine coolant and the engine oil.
4. Remove the cylinder head.
5. Remove the radiator.
6. On 4WD vehicles, remove the front differential.
7. Remove the oil pan.
8. If equipped with P/S, remove the power steering belt.
9. If equipped with A/C, remove the A/C belt, compressor, and the bracket.
10. Remove the fluid coupling with the fan and the water pump pulley.
    a. Loosen the water pump pulley bolts. Loosen the belt adjusting bolt and the pivot bolt of the alternator and remove the drive belt.
    b. Remove the set nuts, the fluid coupling with the fan, and the water pump pulley.
11. Remove the crankshaft pulley.
12. Remove the water bypass pipe.
13. Remove the fan belt adjusting bar. With P/S, remove the lower P/S bracket.
14. Disconnect the heater water outlet pipe.
15. Remove the chain cover assembly. Remove the bolts shown by the arrows.

To install:

16. Install the timing chain cover assembly.
    a. Remove the old cover gaskets and install new gaskets.
    b. Slide the cover assembly over the dowels and the pump spline. Tighten the 8 mm bolts to 9 ft. lbs. (13 Nm) and the 10 mm bolts to 29 ft. lbs. (13 Nm).
17. Install the fan belt adjusting bar to the chain cover and the cylinder head. Tighten to 9 ft. lbs. (13 Nm).
18. Install the heater water outlet pipe.
19. Install the water bypass pipe.
20. Install the crankshaft pulley and tighten the bolt to 116 ft. lbs. (157 Nm).
21. Install the water pump pulley and the fluid coupling with the fan. Place the belt onto each pulley. While pulling the belt tight, tighten the four nuts.
22. Adjust the drive belt tension.
23. If removed, install the A/C compressor bracket, the compressor and the belt.
24. If removed, install the P/S belt.
25. Apply seal packing to the joint part of the cylinder block, the chain cover, the cylinder block, the rear oil seal retainer and the oil pan. Install the oil pan over the studs on the block and tighten the nuts and bolts to 9 ft. lbs. (13 Nm).
26. Install the radiator.
27. Install the cylinder head.
28. If removed, install the front differential.
29. Fill with engine coolant and engine oil.
30. Connect the negative battery cable.
31. Start the engine and check the ignition timing.

SEAL REPLACEMENT

Cover Removed

➧ See Figures 246 and 247

1. Unbolt the timing chain cover assembly. Be careful to loosen only the correct bolts.
2. Pry out the seal from the cover with a flat-bladded tool.
3. It is a good idea to remove the oil pump from the timing cover and replace the O-ring.

To install:

4. Clean and inspect the timing cover area. Install new gaskets around the dowel areas and pump spline.
5. Apply multi-purpose grease to the new oil seal lip.
6. Tap the seal into place with SST 09223-50010/60010 or equivalent, and a hammer. Do this until the seal surface is flush with the cover edge.
7. Install the cover, tighten the bolts as specified for your engine.
8. If the oil pump was removed, install a new O-ring behind the pump prior to installation.

Cover Not Removed

➧ See Figures 248 and 249

1. Unbolt and remove the oil pump.
2. Using a knife, carefully cut off the oil seal lip. With a flat-bladded tool, (preferably with tape around it) pry the seal from the cover.

To install:

3. Apply multi-purpose grease to the new oil seal lip.
4. Tap the seal into place with SST 09223-50010/60011 or equivalent, and a hammer. Do this until the seal surface is flush with the cover edge.
5. Install the oil pump with a new O-ring.

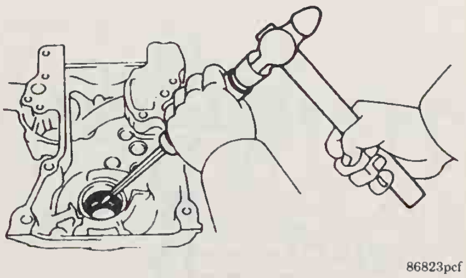


Fig. 246 Remove the seal with a flat-bladded tool and hammer

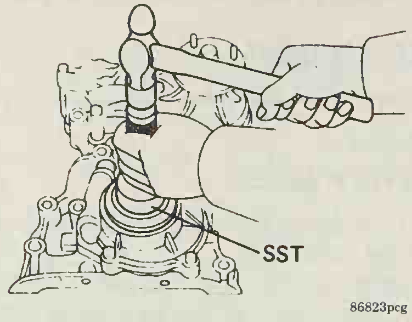


Fig. 247 Install the seal using a proper sized driver

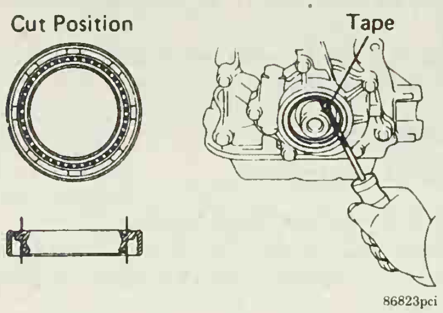


Fig. 248 Carefully cut off the oil seal lip, then pry the seal from the cover

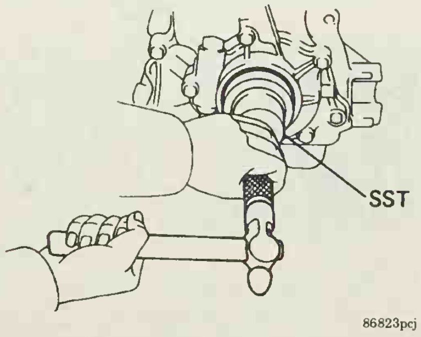


Fig. 249 Drive the seal flush against the cover edge

Timing Gear Cover and Seal

REMOVAL & INSTALLATION

See Figures 250, 251, 252, 253, 254, 255, 256 and 257

➡This procedure applies to the 3F-E engines only.

1. Disconnect the negative battery cable.
2. Disconnect the accelerator and throttle cables.
3. Tag and disconnect, then remove the air intake hose, air flow meter and air cleaner as an assembly.
4. Loosen the power steering pump drive pulley nut.
5. Remove the fluid coupling with the fan and water pump pulley.
6. Remove the power steering pump and the A/C compressor along with their brackets.
7. Remove the power steering idler pulley and it's bracket.
8. Remove the distributor.
9. Remove the valve rocker shaft assembly.
10. Remove the ten bolts, two nuts, pushrod cover and gasket off the pushrod cover.
11. Remove the valve lifters, place them in the exact order as removed.
12. Remove the power steering pulley from the crankshaft pulley.
13. Using SST 09213-58011 and SST 09330-00021 or equivalent, along with a 46mm socket, remove the pulley mount bolt for the crankshaft.
14. Remove the pulley using SST 09213-60017 or an equivalent puller.
15. Remove the oil cooler pipe with the hose.
16. Remove the timing gear cover and gasket.

To install:

17. Clean all the gasket mating areas. With multi-purpose grease, install a new seal into the timing cover. A seal installer will be needed for this job such as 09223-50010.
18. There are three sizes of timing gear cover bolts. Apply adhesive to the two A bolts. Install a new gasket and then position the cover. Finger tighten all the bolts. Align the crankshaft pulley set key with the groove of the pulley; gently tap the pulley onto the crankshaft. Tighten the cover bolts marked **A** to 18 ft. lbs. (25 Nm); and the **B** and **C** to 43 inch lbs. (5 Nm).
19. Tighten the pulley bolt to 253 ft. lbs. (343 Nm). Use of the counter-holding tool is required.
20. Position the power steering pulley on the crankshaft and tighten the six bolts to 13 ft. lbs. (18 Nm).
21. Insert the valve lifters into their bores and install the pushrod cover. Tighten the bolts to 35 inch lbs. (4 Nm) Make sure the valve lifters are installed in the same order as they were taken out.
22. Install the pushrods, rocker shaft assembly, and the valve cover.
23. Install the distributor.
24. Install the water pump pulley, fluid coupling and fan.
25. Install the power steering pump idler pulley and bracket. Install the power steering pump and the A/C compressor. Adjust the belt tensions.
26. Install the air cleaner assembly; connect and adjust the accelerator and throttle cables.

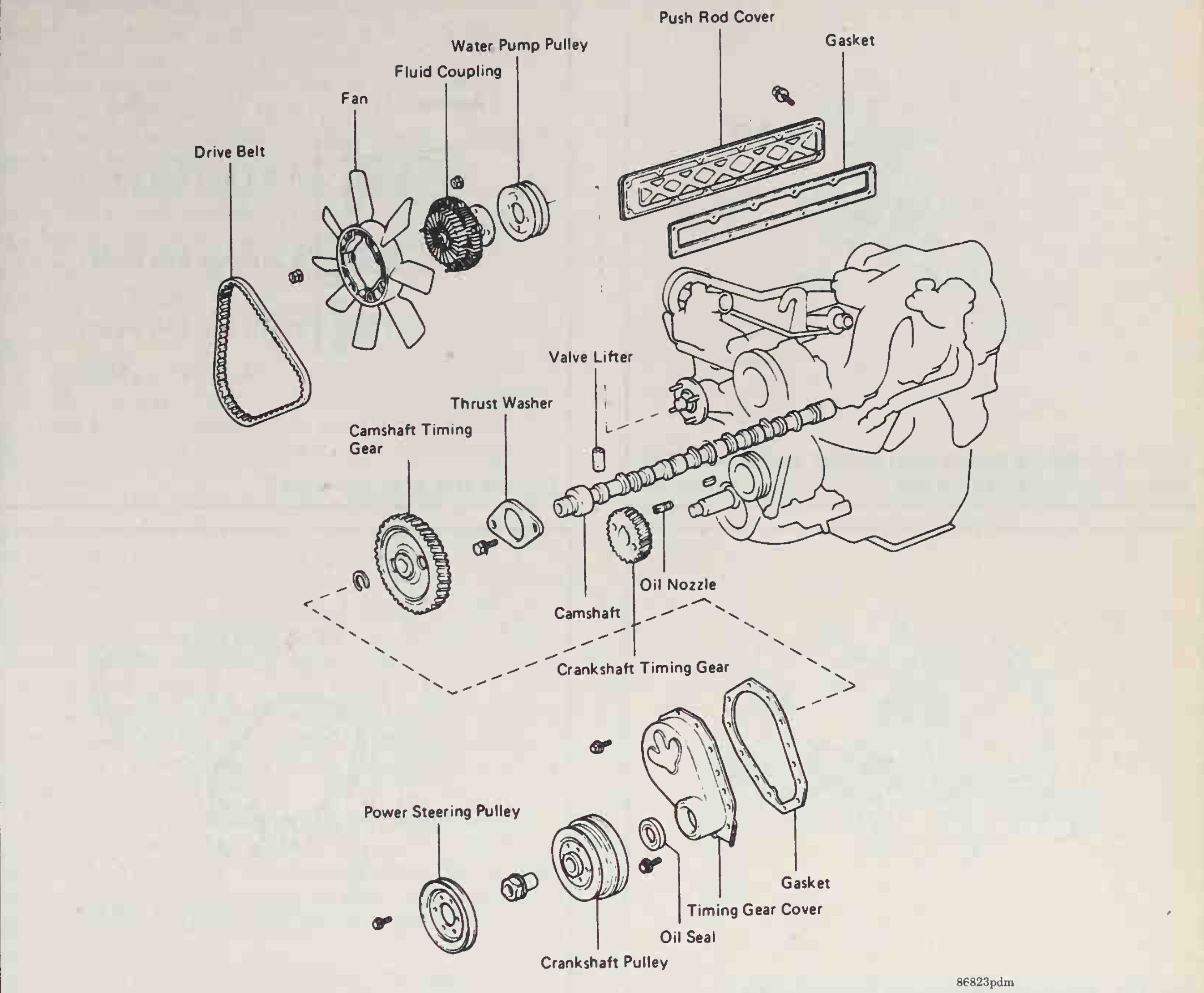

Push Rod Cover
Gasket
Water Pump Pulley
Fluid Coupling
Fan
Drive Belt
Valve Lifter
Thrust Washer
Camshaft Timing Gear
Oil Nozzle
Camshaft
Crankshaft Timing Gear
Power Steering Pulley
Gasket
Timing Gear Cover
Oil Seal
Crankshaft Pulley
86823pdm

Fig. 250 Exploded view of the timing gear assembly on the 3F-E engine

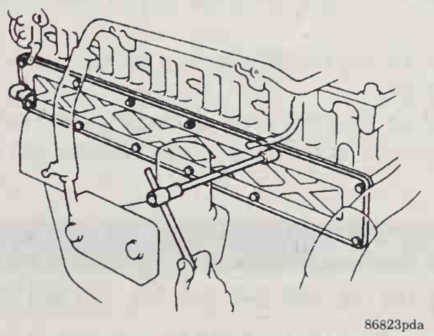


Fig. 251 Remove the bolts securing the pushrod cover

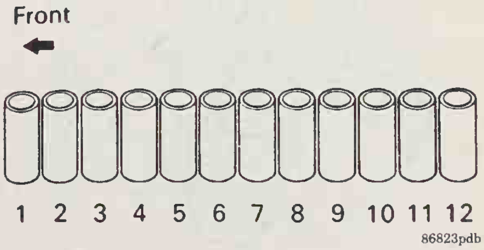

Front
1
2
3
4
5
6
7
8
9
10
11
12
86823pdb

Fig. 252 Place the lifters in the exact order of removal

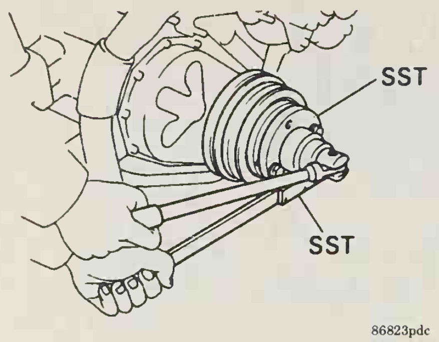

SST
SST
86823pdc

Fig. 253 A special tool is used to hold the crankshaft pulley while loosening the bolt

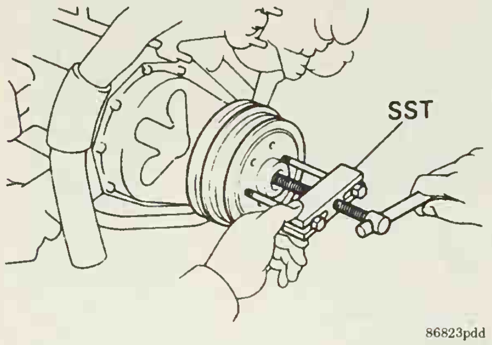

SST
86823pdd

Fig. 254 A puller must be used to remove the crankshaft pulley

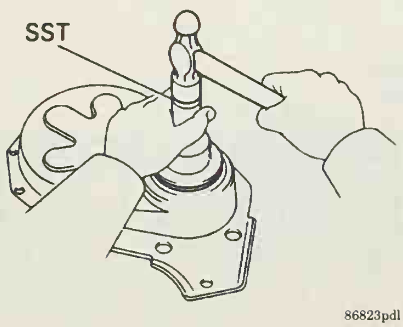

SST
86823pdl

Fig. 255 Use an appropriate sized driver to seat the seal

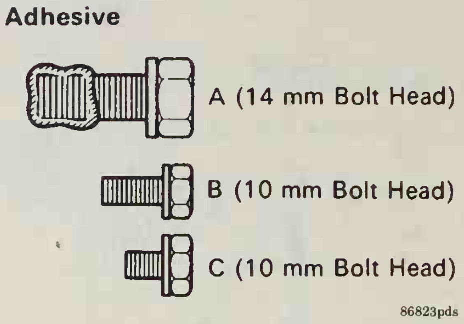

Adhesive
A (14 mm Bolt Head)
B (10 mm Bolt Head)
C (10 mm Bolt Head)
86823pds

Fig. 256 Bolt type and sizes

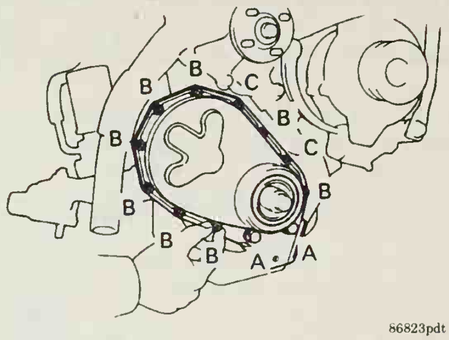

B
B
C
B
B
C
B
B
B
B
A
A
86823pdt

Fig. 257 Cover mounting bolt locations

27. Fill the engine with coolant. Connect the battery cables.
28. Start the engine and check for leaks. Top off the coolant and engine oil if needed.
29. Inspect the timing (7° BTDC at idle), and adjust if needed.
30. Shut the engine **OFF**. Remove the valve cover and adjust the valves.
31. Reinstall the valve cover and road test the vehicle. Check for any abnormal noise, shock, slippage and smooth operation.

Timing Gears

➧ See Figures 258, 259, 260, 261, 262, 263 and 264

➡This procedure applies to 3F-E engines only.

1. Remove the timing gear cover and gasket.
2. Using a flat-bladded tool and a hammer, tap out the old oil seal from the cover.

3. Check the timing gear backlash. Using a dial indicator, measure the backlash at several places while turning the camshaft clockwise and counterclockwise.

Standard backlash:0.0039-0.0072 in. (0.100-0.183mm)
Maximum backlash:0.0098 in. (0.25mm)

4. If the backlash is greater than the maximum, replace the camshaft and crankshaft timing gears.
5. Align the large (camshaft) gear so that the holes allow access to the camshaft retaining bolts. Remove the bolts and very carefully remove the cam with the gear attached. Use great care not to damage the bearing surfaces on the way out.
6. Tap out the gear set key.
7. With a puller or SST 09213-60017, remove the timing gear.
8. If necessary, remove the oil nozzle.
9. Use snapring pliers to remove the snapring holding the cam gear. Mount the camshaft in a press and, using the proper size tip on the press, press the cam out of the gear.

To install:

10. Clean all the gasket mating areas. With multi-purpose grease, install a new seal into the timing cover. A seal installer will be needed for this job such as 09223-50010.
11. Install the timing gear set key to the camshaft. Assemble the cam, thrust plate and timing gear. Use a press with the proper installation tool. Align the timing gear set key with the groove in the gear and press in the camshaft.
12. Install the snapring.
13. Use a thickness gauge to measure the thrust clearance between the thrust plate and camshaft. Correct clearance is 0.200mm-0.290mm (0.0079-0.0114 in.). Maximum allowance is 0.33mm (0.0130 in.).
14. Put the timing gear on the crankshaft with the timing gear facing forwards. Align the timing gear set key with the groove of the timing gear. Use a small mallet to tap the gear into place. Use a plastic mallet to tap in the pulley set key.
15. Turn the crankshaft timing gear clockwise to place the key groove upwards.
16. Insert the camshaft into the block. Take great care not to damage the camshaft bearing surfaces on the way in.
17. Align the timing marks of the crankshaft and camshaft. Note that the one mark is on a tooth, the other in a valley.

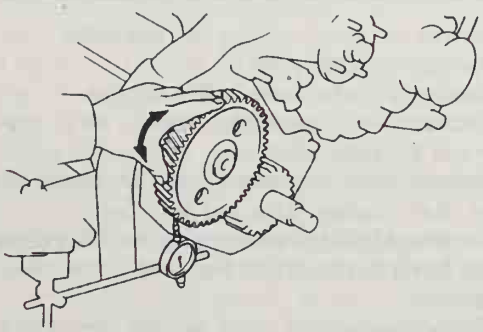


Fig. 258 Use a dial indicator to check the timing gear backlash

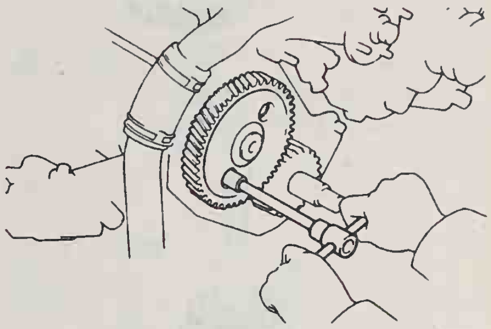


Fig. 259 Remove the camshaft retaining bolts through the access holes

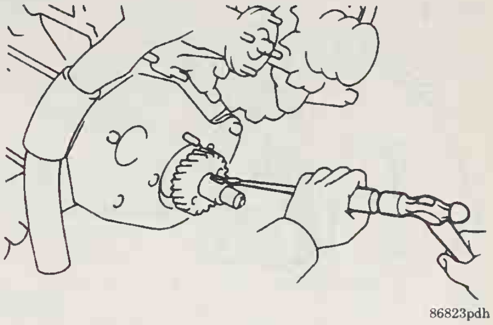


Fig. 260 Carefully tap out the key

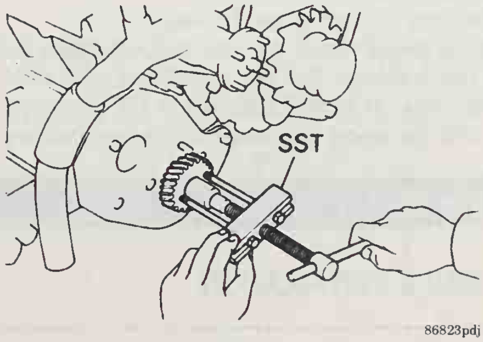


Fig. 261 Remove the gear by using an appropriate puller

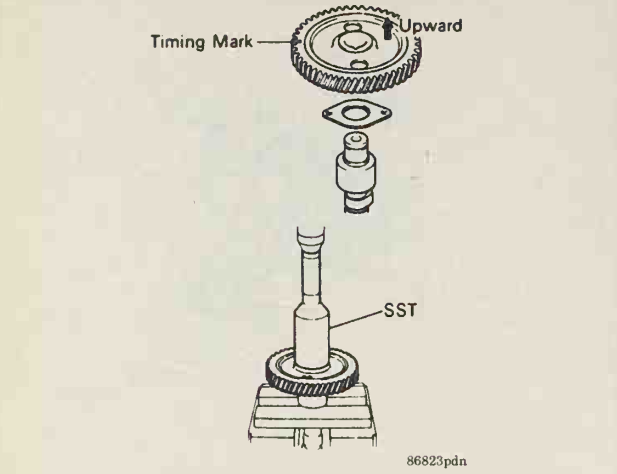


Fig. 262 A press must be used to remove and install the camshaft gear

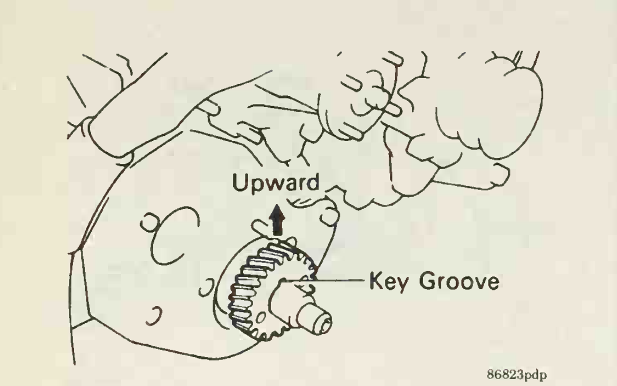


Fig. 263 Turn the crankshaft timing gear clockwise to place the key groove upwards

The tooth and valley must align exactly. Cylinder No. 6 should be at TDC compression if everything is set properly.

18. Install the two bolts holding the thrust washer to the block; tighten to 9 ft. lbs. (12 Nm).
19. Recheck the timing gear backlash.
20. Install the oil nozzle if it was removed. Make certain the oil hole points towards the gear mesh area. Use a hammer and small chisel to stake the threads of the oil nozzle.
21. Install the timing gear cover with a new seal and gasket.

Timing Belt

REMOVAL & INSTALLATION

If you operate your vehicle under conditions of extensive idling and or low speed driving for long periods of time; such as a taxi, police or delivery service, replace the belt every 60,000 miles (96,000 km).

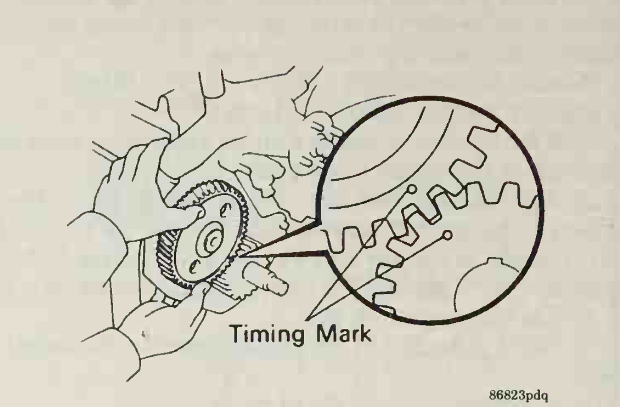


Fig. 264 Align the timing marks of the crankshaft and camshaft

3VZ-E Engine

➧ See Figures 265, 266, 267, 268, 269, 270, 271, 272, 273 and 274

✲✲WARNING

This procedure requires tools which may not be in your tool box. Pulley extractors and a counter-holding bar are required. Do not attempt the procedure without these tools available.

1. Disconnect the negative battery cable and drain the coolant.
2. Remove the radiator and shroud.

✲✲CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Remove the power steering belt and pump.
4. Remove the spark plugs.
5. Disconnect the air hoses at the air pipe.
6. Disconnect the water bypass hose at the air pipe and then remove the water outlet.
7. Remove the air conditioning belt. Remove the alternator drive belt, fluid coupling, guide and fan pulley.
8. Disconnect the high tension cords and their clamps at the upper timing belt cover and then remove the cover and its three gaskets.
9. Rotate the crankshaft pulley until the groove on its lip is aligned with the 0 on the lower timing belt cover. This should set the No. 1 cylinder at TDC of its compression stroke. The matchmarks on the camshaft timing pulleys must be in alignment with those on the upper rear timing cover. If not, rotate the engine 360° (one complete revolution).

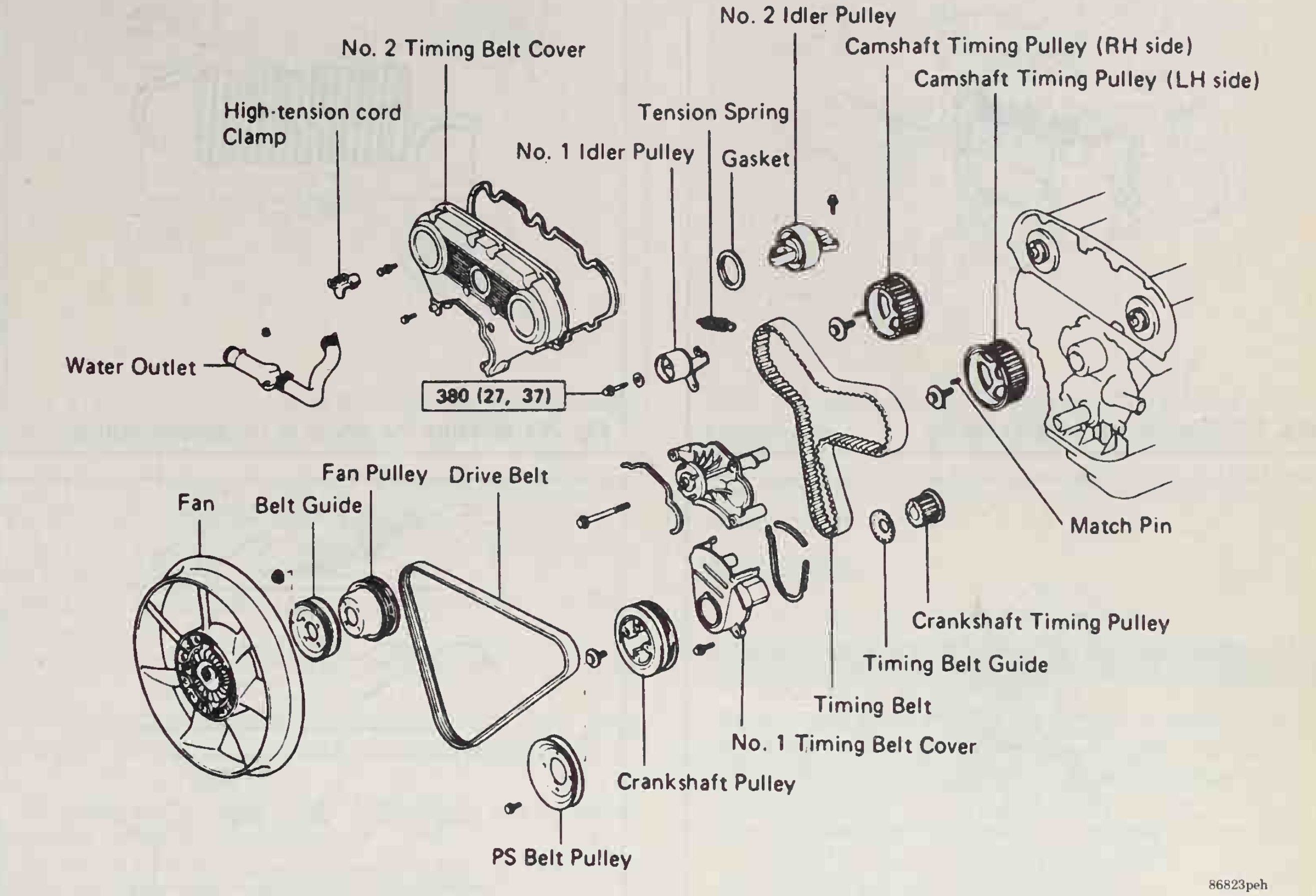

No. 2 Idler Pulley
Camshaft Timing Pulley (RH side)
Camshaft Timing Pulley (LH side)
No. 2 Timing Belt Cover
High-tension cord Clamp
Tension Spring
No. 1 Idler Pulley
Gasket
Water Outlet
380 (27, 37)
Fan Pulley
Drive Belt
Fan
Belt Guide
Match Pin
Crankshaft Timing Pulley
Timing Belt Guide
Timing Belt
No. 1 Timing Belt Cover
Crankshaft Pulley
PS Belt Pulley
86823peh

Fig. 265 Exploded view of the 3VZ-E engine timing belt routing

10. Remove the power steering pulley. Use the counter-holding tool to aid in removal of the crank pulley bolt. Remove the crankshaft pulley using a puller.

11. Remove the fan pulley bracket and then remove the lower timing belt cover.

12. If the belt is to be reused after removal, mark an arrow on the belt showing the direction of rotation. Make matchmarks on the side of the belt and the flanges of each pulley. These marks will be important at reassembly.

13. Remove the timing belt guide and remove the tension spring.

14. Loosen the idler pulley bolt and shift the idler to the left as far as it will go. Temporarily tighten the bolt and release tension from the belt. Slide the belt off the pulleys.

15. Protect the belt at all times. Do not bend, twist or turn the belt inside out. Do not allow the belt to contact oil, grease or water.

16. Examine the belt closely for cracking, loose teeth, separation or wear on the edges. If the belt is not virtually perfect, replace it.

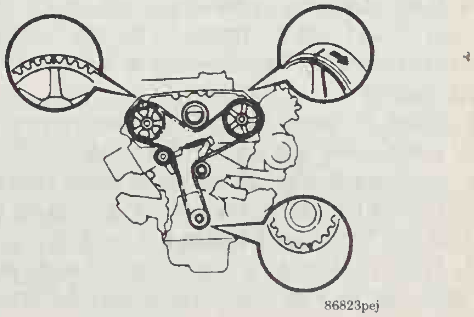


Fig. 266 Mark the position of the belt if it is to be reused

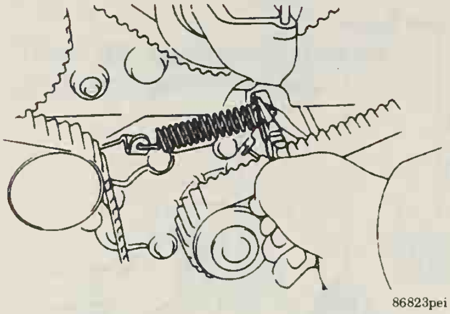


Fig. 267 Remove the tension spring

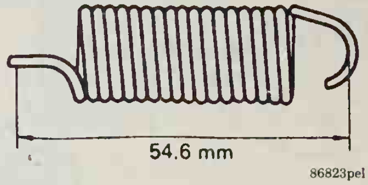


Fig. 269 Measure the length of the tension spring

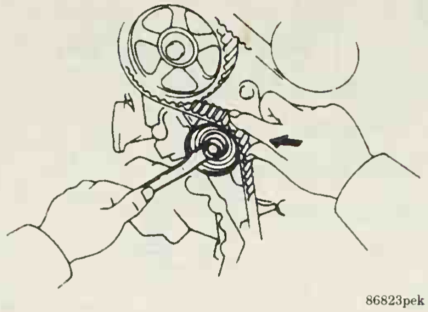


Fig. 268 Move the tensioner all the way to the left, then tighten the bolt

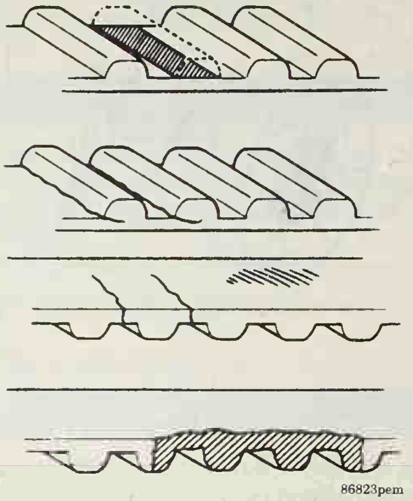


Fig. 270 Inspect the belt for any signs of damage

17. Check the idler pulleys for smoothness of rotation. Inspect the tension spring; correct length is 2.15 in. (54.6mm).

To install:

18. Make absolutely certain the marks on the camshaft pulleys are aligned with the marks on the rear belt cover. Check the lower belt pulley; align its mark with the mark on the oil pump housing.
19. Install the timing belt onto the cam pulleys, idler pulley, water pump pulley and crank pulley. If reusing the original belt, take great care to align all the marks made before removal.
20. Loosen the idler pulley bolt; move it as far to the right as it will go. Temporarily tighten it in position.
21. Install the tension spring. Loosen the idle pulley bolt to the point that the idler pulley moves with the tension of the spring.
22. Temporarily install the crankshaft pulley bolt. Turn the crankshaft clockwise two complete revolutions from TDC to TDC. Check that the mark on each pulley aligns exactly with the matching marks on the covers or housing.
23. Tighten the idler pulley bolt to 27 ft. lbs. (37 Nm).

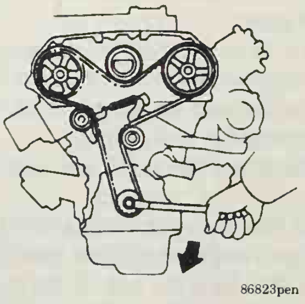


Fig. 271 Always turn the engine in a clockwise direction

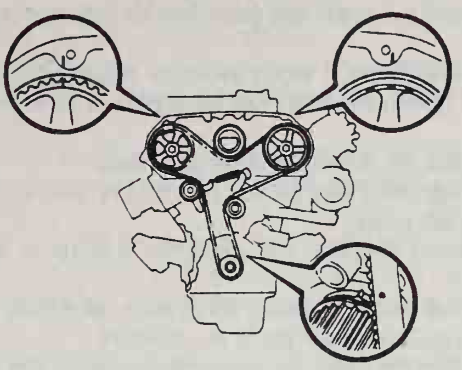


Fig. 272 After rotating the engine, ALL the timing marks must align perfectly

24. Remove the crank pulley bolt. Install the belt guide on the crankshaft pulley. The cupped side faces outward.
25. Install the bottom belt cover with the two gaskets.tighten the bolts to (5 Nm).
26. Install the fan pulley bracket and tighten it to 30 ft. lbs. (41 Nm).
27. Install the upper cover and tighten the bolts 48 inch lbs. (5 Nm).
28. Position the crankshaft pulley so the groove in the pulley is aligned with the woodruff key in the crankshaft. Tighten the bolt to 181 ft. lbs. (245 Nm).
29. Install the fan pulley, guide, fluid coupling and alternator drive belt. Adjust the belt tension.
30. Install the power steering pump and belt. Install the air conditioning belt. Adjust the belt tension.
31. Apply sealant to the contact surface of the water outlet. Install the water outlet and connect the bypass hose. Connect the air hoses.
32. Install the spark plugs.
33. Install the radiator and fill with coolant.

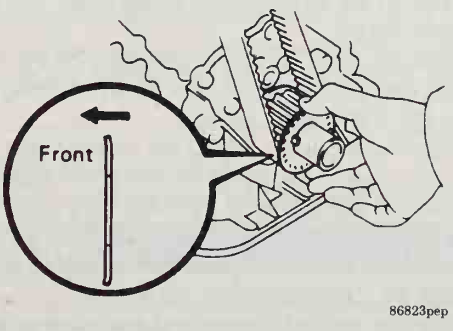


Fig. 273 Install the belt guide with the cupped side out

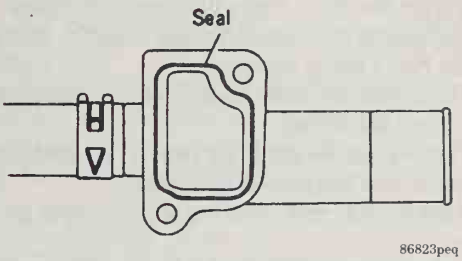


Fig. 274 Apply sealant to the water outlet before installation

34. Road test the vehicle. Check for leaks. Recheck the ignition timing.

5VZ-FE Engine

1. Disconnect the negative battery cable.

CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Remove the engine under cover.
4. Drain the engine coolant.

CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

5. Disconnect the upper radiator hose from the engine.
6. Remove the Power Steering (P/S) drive belt as follows:
   a. Loosen the fan pulley mounting nuts.
   b. Loosen the lock bolt, pivot bolt, and the adjusting bolt. Remove the drive belt from the engine.
7. Remove the A/C drive belt by loosening the idler pulley nut and the adjusting bolt.
8. Loosen the lock bolt, pivot bolt, and the adjusting bolt and the alternator drive belt.
9. Remove the fan shroud by removing the two clips.
10. Remove the fan with the fluid coupling and fan pulleys.
11. Disconnect the P/S pump from the engine and set aside. Do not disconnect the lines from the pump.

12. If equipped with A/C, disconnect the compressor from the engine and set aside. Do not disconnect the lines from the compressor.
13. If equipped with A/C, disconnect the A/C bracket.
14. Remove the No. 2 timing belt cover as follows:
    a. Disconnect the camshaft position sensor connector from the No. 2 timing belt cover.
    b. Disconnect the three spark plug wire clamps from the No. 2 timing belt cover.
    c. Remove the six bolts and remove the timing belt cover.
15. Remove the fan bracket as follows:
    a. Remove the power steering adjusting strut by removing the nut.
    b. Remove the fan bracket by removing the bolt and nut.
16. Set the No. 1 cylinder at TDC of the compression stroke as follows:
    a. Turn the crankshaft pulley and align its groove with the timing mark **0** of the No. 1 timing belt cover.
    b. Check that the timing marks of the camshaft timing pulleys and the No. 3 timing belt cover are aligned. If not, turn the crankshaft pulley one revolution (360°).

➡If re-using the timing belt, make sure that you can still read the installation marks. If not, place new installation marks on the timing belt to match the timing marks of the camshaft timing pulleys.

17. Remove the timing belt tensioner by alternately loosening the two bolts.
18. Using SST 09960-10010 or equivalent, remove the pulley bolt, the timing pulley and the knock pin. Remove the two timing pulleys with the timing belt.
19. Remove the crankshaft pulley as follows:
    a. Using SST 09213-54015 and 09330-00021, or equivalent, loosen the pulley bolt.
    b. Remove the SST tool, the pulley bolt, and the pulley.
20. Remove the starter wire bracket and the No. 1 timing belt cover.
21. Remove the timing belt guide and remove the timing belt.
22. Remove the bolt and the No. 2 idler pulley.
23. Remove the pivot bolt, the No. 1 idler pulley, and the plate washer.
24. Remove the crankshaft gear.

To install:

25. Install the crankshaft timing gear as follows:
    a. Align the timing pulley set key with the key groove of the gear.
    b. Using SST 09214-60010, or equivalent, and a hammer, tap in the timing gear with the flange side facing inward.
26. Install the plate washer and the No. 1 idler pulley with the pivot bolt and tighten to 26 ft. lbs. (35 Nm). Check that the pulley bracket moves smoothly.
27. Install the No. 2 timing belt idler with the bolt. Tighten the bolt to 30 ft. lbs. (40 Nm). Check that the pulley bracket moves smoothly.
28. Temporarily install the timing belt.
    a. Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and the oil pump body.
    b. Align the installation mark on the timing belt with the dot mark of the crankshaft timing pulley.
    c. Install the timing belt on the crankshaft timing pulley, No. 1 idler, and the water pump pulleys.
29. Install the timing belt guide with the cup side facing outward.
30. Install the No. 1 timing belt cover and starter wire bracket. Tighten the timing belt cover bolts to 80 inch lbs. (9 Nm).
31. Install the crankshaft pulley as follows:
    a. Align the pulley set key with the key groove of the crankshaft pulley.
    b. Install the pulley bolt and tighten it to 184 ft. lbs. (250 Nm).
32. Install the left camshaft timing pulley as follows:
    a. Install the knock pin to the camshaft.
    b. Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley.
    c. Slide the timing pulley on the camshaft with the flange side facing outward. Tighten the pulley bolt to 81 ft. lbs. (110 Nm).
33. Set the No. 1 cylinder to TDC of the compression stroke as follows:
    a. Turn the crankshaft pulley, and align its groove with the timing mark **0** of the No. 1 timing belt cover.
    b. Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the No. 3 timing belt cover.
    c. Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and the No. 3 timing belt cover.
34. Connect the timing belt to the left camshaft timing pulley. Check that the installation mark on the timing belt is aligned with the end of the No. 1 timing belt cover as follows:
    a. Using SST 09960-01000 or equivalent, slightly turn the left camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the left camshaft timing pulley.
    b. Align the timing marks of the left camshaft pulley and the No. 3 timing belt cover.
    c. Check that the timing belt has tension between the crankshaft timing pulley and the left camshaft timing pulley.
35. Install the right camshaft timing pulley and the timing belt as follows:
    a. Align the installation mark on the timing belt with the timing mark of the right camshaft timing pulley, and hang the timing belt on the right camshaft timing pulley with the flange side facing inward.
    b. Slide the right camshaft timing pulley on the camshaft. Align the timing marks on the right camshaft timing pulley and the No. 3 timing belt cover.
    c. Align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin. Install the bolt and tighten to 81 ft. lbs. (110 Nm).
36. Set the timing belt tensioner as follows:
    a. Using a press, slowly press in the pushrod using 220-2,205 lbs. (981-9,807 N) of force.
    b. Align the holes of the pushrod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the pushrod.
    c. Release the press and install the dust boot to the tensioner.

37. Install the timing belt tensioner and alternately tighten the bolts to 20 ft. lbs. (28 Nm). Using pliers, remove the 1.5 mm hexagon wrench from the belt tensioner.

38. Check the valve timing as follows:

a. Slowly turn the crankshaft pulley two revolutions from the TDC to TDC. Always turn the crankshaft pulley clockwise.

b. Check that each pulley aligns with the timing marks. If the timing marks do not align, remove the timing belt and reinstall it.

39. Install the fan bracket with the bolt and nut.

40. Install the power steering adjusting strut with the nut.

41. Install the No. 2 timing belt cover. Tighten the bolts to 80 inch lbs. (9 Nm).

42. Connect the three clamps for the spark plug wires to the No. 2 timing belt cover.

43. Connect the camshaft position sensor connector to the No. 2 timing belt cover.

44. If equipped, install the A/C compressor bracket.

45. If equipped, install the A/C compressor.

46. Install the fan with the fluid coupling and fan pulleys. Tighten the nuts to 48 inch lbs. (6 Nm).

47. Install the fan shroud.

48. Install the alternator drive belt.

49. Install the cooling fan and tighten the nuts to 4 ft. lbs. (6 Nm).

50. If equipped, install and adjust the A/C drive belt.

51. Install the P/S pump, pump pulley, and the drive belt.

52. Connect the upper radiator hose.

53. Install the engine undercover.

54. Fill the cooling system with coolant.

55. Connect the negative battery cable.

56. Start the engine and check for leaks.

Timing Chain

REMOVAL & INSTALLATION

22R and 22R-E Engines

◗ See Figures 275, 276, 277 and 278

⁂WARNING

This procedure requires tools which may not be in your tool box. Pulley extractors and a counter-holding bar are required. Do not attempt the procedure without these tools available.

1. Remove the cylinder head.

2. Drain the cooling system and remove the radiator.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. On 4WD vehicles, remove the front differential.

4. Remove the oil pan.

5. Remove the power steering belt if so equipped.

6. Remove the air conditioning belt, compressor and bracket if so equipped.

7. Remove the fan clutch (fluid coupling), with the fan and water pump pulley.

8. Matchmark and remove the crankshaft pulley(s). This bolt will be very tight. Use the counter-holding bar, properly installed, to hold the crankshaft while loosening the bolt. Use the pulley extractor or gear puller to remove the pulley from the shaft.

9. Remove the water bypass pipe.

10. Remove the fan belt adjusting bar. If necessary, remove the lower power steering bracket for access.

11. Disconnect the heater water outlet pipe.

12. Unbolt the timing chain cover assembly. Be careful to loosen only the correct bolts.

13. Remove the chain from the crankshaft sprocket. Remove the camshaft sprocket and the chain upwards.

14. Remove the oil pump drive splines and the crankshaft sprocket.

To install:

15. Remove any gasket material left on the cylinder block.

16. Turn the crankshaft until the shaft key is on top.

17. Slide the sprocket over the key on the crankshaft. Place the timing chain on the sprocket with the single bright link aligned with the timing mark on the sprocket.

18. Place the timing chain on the cam sprocket so that the link BETWEEN the two bright links is aligned with the timing mark on the sprocket. Make certain the chain is positioned within the dampers (guides).

19. Turn the camshaft sprocket counter-clockwise (viewed from the front) to take slack out of the chain. Rest or support the camshaft sprocket and chain at the top of the block.

20. Install the oil pump drive over the crankshaft key. It may be necessary to use a seal or bearing installing tool.

21. Install new gaskets over the dowels on the timing chain cover. Slide the cover assembly over the dowels and pump spline. Insert the retaining bolts and tighten them. Tighten the

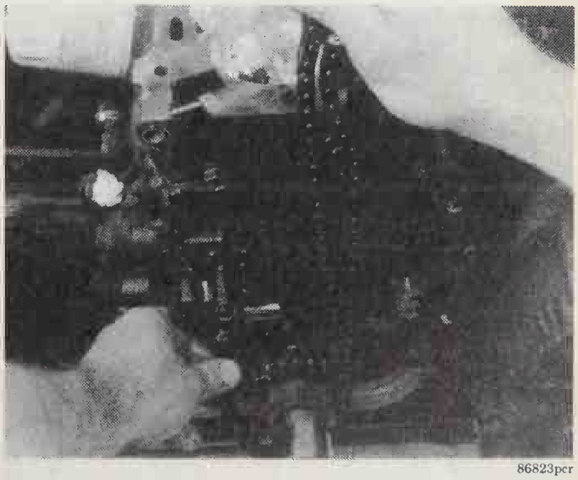


Fig. 275 The chain can be removed after the front cover is removed

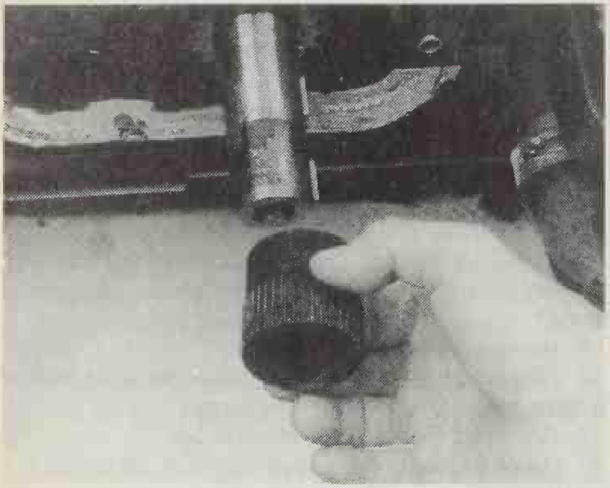

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Fig. 276 The drive spline comes off first . . .

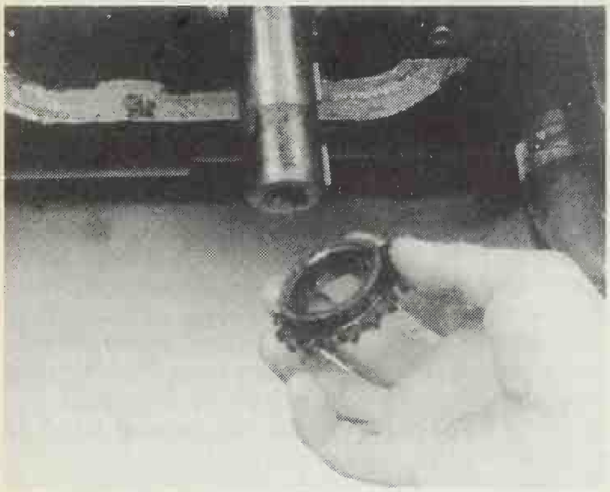
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Fig. 277 . . . then the crankshaft sprocket

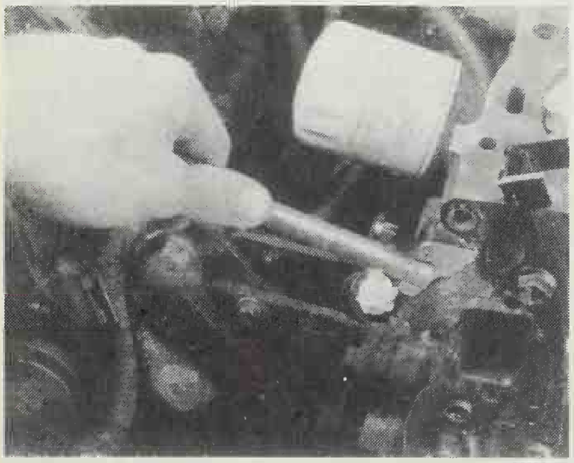
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Fig. 278 Using a scraper, clean the gasket areas thoroughly

8mm bolts to 9 ft. lbs. (13 Nm) and the 10mm bolts to 29 ft. lbs. (39 Nm).

22. Temporarily install the adjusting bar to the alternator. Install the adjusting bar to the chain cover and tighten the bolts to 9 ft. lbs. (13 Nm).
23. Install the heater water outlet pipe.
24. Install the water bypass pipe.
25. Install the crankshaft pulley and bolt. Use the counter-holding tool to hold the pulley and tighten the bolt to 116 ft. lbs. (157 Nm). If equipped with air conditioning, install the second crankshaft pulley.
26. Install the water pump pulley and fluid coupling with the fan.
27. Adjust the tension on the drive belts.
28. Install the air conditioning compressor bracket, compressor and belt if they were removed.
29. Install the power steering belt and adjust it.
30. Attach the oil pan.
31. Install the radiator.
32. Install the front differential.
33. Install the cylinder head.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289 and 290

1. Disconnect the negative battery cable.

✲✲CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Remove the engine under cover.
4. Drain the engine coolant and the engine oil.
5. On 4WD vehicles, remove the front differential.
6. Remove the alternator belt, fan with coupling and the water pump pulley.
   a. Loosen the water pump pulley bolts. Loosen the belt adjusting bolt and the pivot bolt of the alternator and remove the drive belt.
   b. Remove the set nuts, the fluid coupling with the fan, and the water pump pulley.
7. Remove the cylinder head.
8. If equipped with A/C, remove the A/C belt, compressor, and the bracket.
9. Remove the alternator adjusting bar and bracket.
10. Unbolt and remove the crankshaft position sensor and O-ring.
11. On 2WD vehicles, remove the stiffener plates.
12. Unbolt the flywheel housing under cover and dust seal.
13. Remove the oil pan.
14. Unsecure the oil strainer and gasket.
15. Remove the crankshaft pulley, a pulley bolt remover will be needed.
16. Remove the water bypass pipe.
17. Remove the chain cover assembly. Remove the bolts shown by the arrows.
18. Remove the No. 1 timing chain and camshaft gear.
19. Remove the crankshaft timing gear.

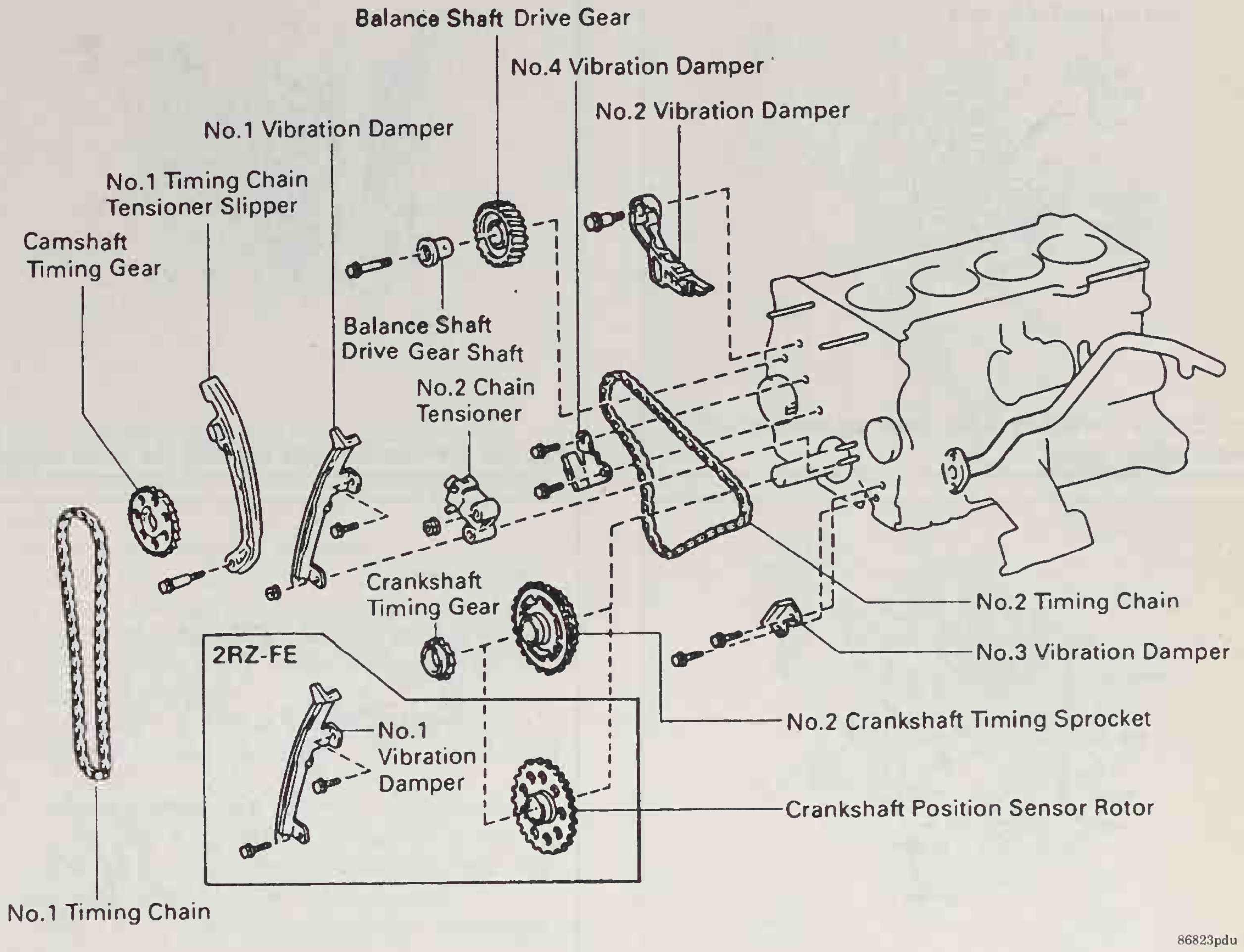
Balance Shaft Drive Gear
No.4 Vibration Damper
No.2 Vibration Damper
No.1 Vibration Damper
No.1 Timing Chain Tensioner Slipper
Camshaft Timing Gear
Balance Shaft Drive Gear Shaft
No.2 Chain Tensioner
Crankshaft Timing Gear
2RZ-FE
No.1 Vibration Damper
No.2 Timing Chain
No.3 Vibration Damper
No.2 Crankshaft Timing Sprocket
Crankshaft Position Sensor Rotor
No.1 Timing Chain
86823pdu

Fig. 279 Exploded view of the 2RZ-FE and 3RZ-FE engine timing chain components

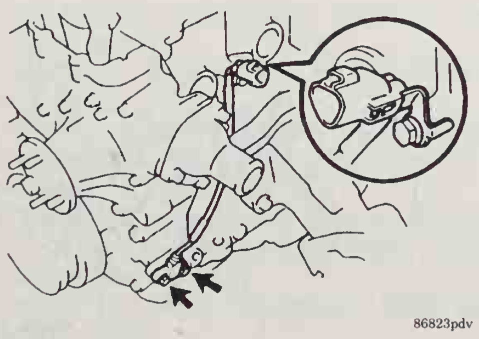

Fig. 280 The crankshaft position sensor is located below the water pump

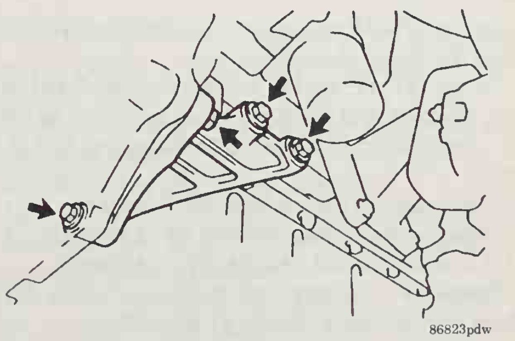

Fig. 281 Remove the bolts securing the stiffener plates

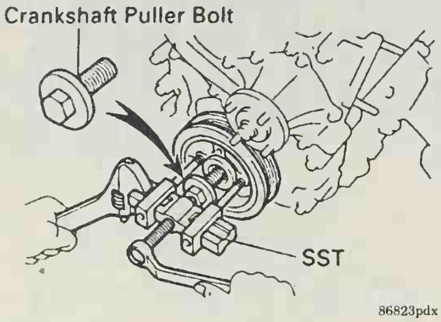

Fig. 282 The crankshaft pulley must be removed with a special puller

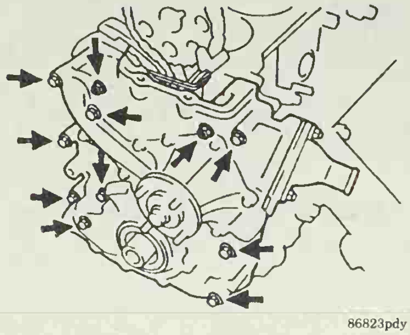

Fig. 283 Remove the bolts securing the front cover

20. Remove the No. 1 timing chain tensioner slipper and No. 1 vibration damper. On the 2RZ-FE, remove the two bolts and the damper. On the 3RZ-FE, remove the bolt, nut and No. 1 damper.

21. On the 2RZ-FE remove the crankshaft position sensor rotor and the timing chain oil jet.

22. On the 3RZ-FE engine, remove the No. 2 and No. 3 vibration dampers and the No. 2 chain tensioner as follows:

  a. Install a pin to the No. 2 tensioner and lock the plunger.

  b. Remove the bolt and the No. 2 damper.

  c. Remove the 2 bolts and the No. 3 damper.

  d. Unsecure the nut and the No. 2 tensioner.

23. Remove the balance shaft driven gear, shaft, No. 2 timing chain and the No. 2 crankshaft sprocket.

  a. Unbolt the balance shaft driven gear.

  b. Remove the balance shaft gear with the shaft.

  c. Remove the No. 2 timing chain with the No. 2 crankshaft timing sprocket.

24. Remove the No. 4 vibration damper.

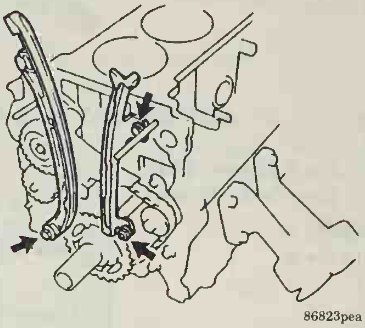

Fig. 284 Remove the bolts securing the chain dampers

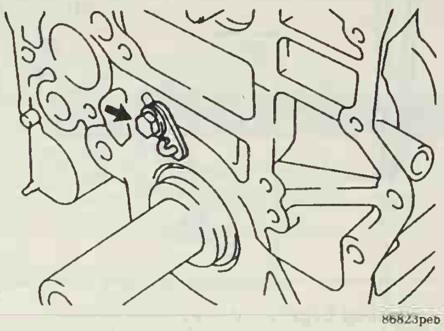

Fig. 285 The oil jet is secured by a single bolt

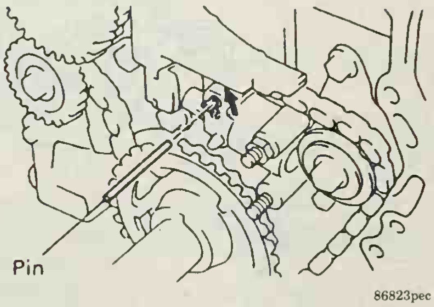

Fig. 286 Lock the plunger with an appropriate pin

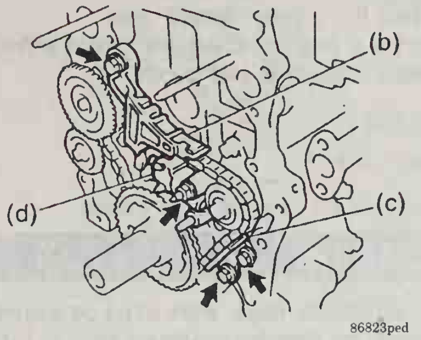

Fig. 287 Fastener locations for the tensioner and damper

To install:

25. Install the No. 4 vibration dampener.

26. Install the No. 2 timing chain, No. 2 crankshaft timing sprocket, balance shaft drive gear and shaft as follows:

a. Install the No. 2 chain by matching the marked links with the timing marks on the crankshaft sprocket and balance shaft timing sprocket.

b. Fit the other mark link of the No. 2 chain onto the sprocket behind the large timing mark of the balance shaft gear.

c. Insert the balance shaft gear shaft through the balance shaft drive gear so that it fits into the thrust plate hole. Align the small timing mark of the balance shaft drive gear with the timing mark of the balance shaft timing gear.

d. Install the bolt to the balance shaft gear and tighten to 18 ft. lbs. (25 Nm).

e. Check each timing mark is matched with the corresponding mark link.

27. Install the No. 2, No. 3 vibration dampers and the No. 2 chain tensioner.

➡Assemble the chain tensioner with the pin installed, then remove the pin after assembly.

a. Install the No. 2 chain tensioner with the nut, tighten to 13 ft. lbs. (18 Nm).

b. Install the No. 3 damper withe the bolts, tighten to 13 ft. lbs. (18 Nm).

c. Install the No. 2 damper, tighten to 20 ft. lbs. (27 Nm).

d. Remove the pin from the No. 2 chain tensioner and free the plunger.

28. On the 2RZ-FE engines, install the oil jet and crankshaft position sensor rotor. Make sure the front mark of the cavity of the rotor is facing forward.

29. Install the No. 1 timing chain tensioner slipper and the No. 1 vibration damper.

a. Install the No. 1 damper, tighten to 22 ft. lbs. (29 Nm).

b. Install the slipper, tighten to 20 ft. lbs. (27 Nm).

c. Check that the slipper moves smoothly.

30. Install the crankshaft timing gear.

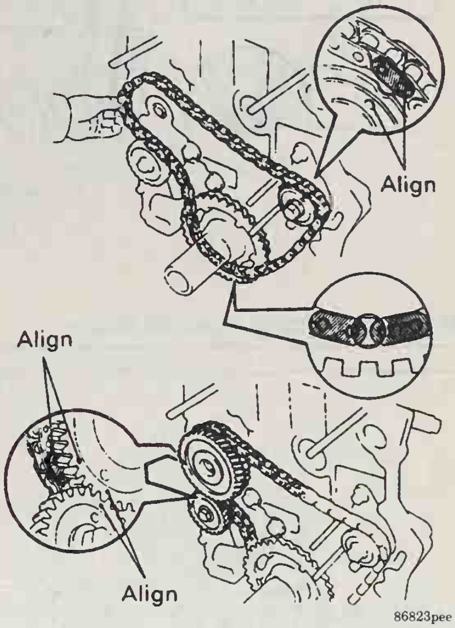

Fig. 288 Align the small timing mark of the balance shaft drive gear with the timing mark of the balance shaft timing gear

31. Install the No. 1 timing chain and camshaft timing gear.

a. Align the timing mark between the mark link of the No. 1 timing chain, and install the No. 1 timing chain to the gear.

b. Align the timing mark of the crankshaft timing gear with the mark of the No. 1 timing chain, then install the No. 1 timing chain.

c. Tie the No. 1 chain with a wire or cord, make sure it does not come loose.

32. Install the timing chain cover assembly.

a. Remove the old cover gaskets and install new gaskets.

b. Slide the cover assembly over the dowels and the pump spline. Tighten the following:

- 12mm **A** bolts — 14 ft. lbs. (20 Nm)
- 12mm **B** bolts — 18 ft. lbs. (25 Nm)
- 14mm bolts — 32 ft. lbs. (44 Nm)
- 14mm nut — 14 ft. lbs. (20 Nm)

c. Attach the water bypass pipe.

d. Remove the cord or wire from the chain.

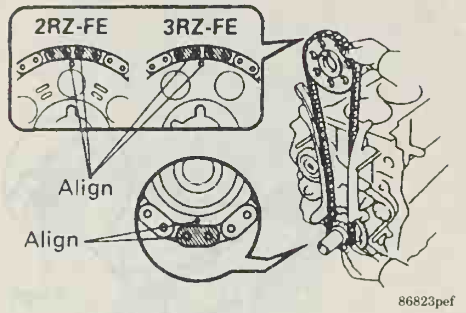

Fig. 289 Align the timing marks as shown

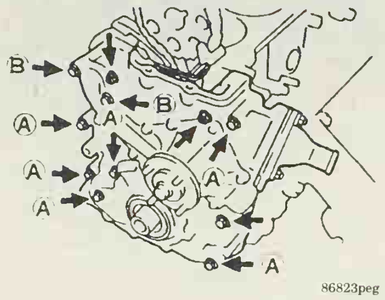

Fig. 290 Timing cover fastener identification

33. Install the crankshaft pulley, tighten the bolt to 193 ft. lbs. (260 Nm). On A/C vehicles, install the crankshaft pulleys with bolts and tighten to 18 ft. lbs. (25 Nm).
34. Install the oil strainer, tighten to 13 ft. lbs. (18 Nm).
35. Attach the oil pan with fresh sealant, tighten the mounting bolts to 9 ft. lbs. (13 Nm).
36. Attach the flywheel housing under cover and dust seal.
37. Attach the stiffener plates on the 2WD vehicles, tighten to 27 ft. lbs. (37 Nm).
38. Install the crankshaft position sensor. with a new O-ring.
39. Install the alternator, adjusting bar and bracket.
40. For vehicles with A/C, install the compressor and bracket.
41. Install the cylinder head.
42. Install the water pump pulley and the fluid coupling with the fan. Place the belt onto each pulley. While pulling the belt tight, tighten the four nuts.
43. On 4WD vehicles, install the front differential and driveshaft assemblies.
44. Lower the vehicle.
45. Adjust the drive belt tension.
46. Fill with engine coolant and engine oil.
47. Install the engine under cover.
48. Connect the negative battery cable.
49. Start the engine and check the ignition timing.
50. Recheck fluid levels and top off.

1FZ-FE Engine

➧ See Figure 291

1. Disconnect the negative battery cable.

⁂CAUTION

On vehicles with air bags, work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Raise and safely support the vehicle.
3. Drain the engine oil and the engine coolant.
4. Remove the engine under cover.
5. Remove the radiator.
6. Disconnect and remove the A/C compressor and the bracket.
7. Remove the radiator pipe. Disconnect the radiator hose from the water inlet.
8. Remove the water pump and the gasket.
9. Remove the cylinder head.
10. Disconnect the oil cooler pipe bracket from the No. 1 oil pan.
11. Remove the oil level sensor.
12. Remove the bolts holding the No. 1 oil pan to the transmission housing.
13. Remove the No. 2 and No. 1 oil pans.
14. Using SST 09213-58012 and 09330-00021, or equivalent, remove the pulley bolt. Remove the crankshaft pulley.
15. Check the thrust clearance of the oil pump driveshaft gear as follows:
    a. Using a dial indicator with a lever type attachment, measure the thrust clearance.
    b. Maximum thrust clearance is 0.0118 in. (0.30 mm).
    c. If the thrust clearance is greater than maximum, replace the oil pump driveshaft gear and/or timing chain cover.
16. Remove the drive belt idler pulley.
17. Remove the timing chain cover.
18. Remove the timing chain and the camshaft timing gear.
19. Pull out the crankshaft timing gear.
20. Remove the chain tensioner slipper and the vibration damper.
21. Remove the oil jet.
22. Remove the crankshaft rotor.
23. Remove the oil pump driveshaft gear.
24. Remove the pump driveshaft gear.

To install:

25. Clean the mating areas well.
26. Set the crankshaft. Turn the crankshaft until the set key on the crankshaft is facing downward (6 o'clock).
27. Install the pump driveshaft gear.
28. Apply a light coat of engine oil on the shaft portion of the oil pump driveshaft gear, and install the gear.
29. Install the crankshaft rotor.

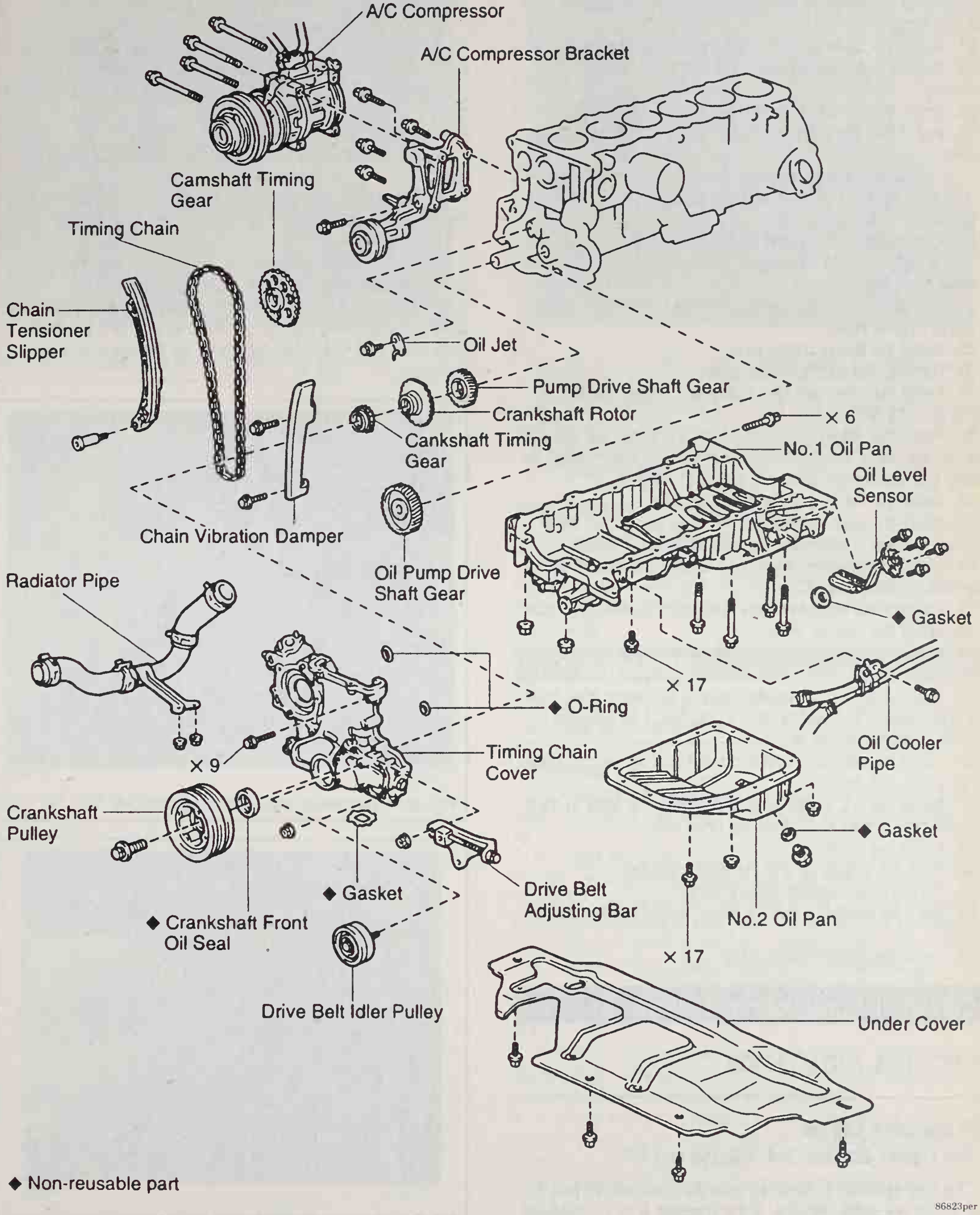
A/C Compressor
A/C Compressor Bracket
Camshaft Timing Gear
Timing Chain
Chain Tensioner Slipper
Oil Jet
Pump Drive Shaft Gear
Crankshaft Rotor
× 6
Cankshaft Timing Gear
No.1 Oil Pan
Oil Level Sensor
Chain Vibration Damper
Radiator Pipe
Oil Pump Drive Shaft Gear
◆ Gasket
× 17
◆ O-Ring
× 9
Timing Chain Cover
Oil Cooler Pipe
Crankshaft Pulley
◆ Gasket
◆ Gasket
Drive Belt Adjusting Bar
◆ Crankshaft Front Oil Seal
No.2 Oil Pan
× 17
Drive Belt Idler Pulley
Under Cover
◆ Non-reusable part
86823per

Fig. 291 Exploded view of the timing chain assembly on the 1FZ-FE engine

30. Install the oil jet and tighten the bolt to 14 ft. lbs. (20 Nm).
31. Install the vibration damper and tighten the bolts to 14 ft. lbs. (20 Nm).
32. Install the chain tensioner slipper and tighten the bolt to 51 ft. lbs. (69 Nm). Make sure that the slipper moves smoothly.
33. Install the crankshaft timing gear.
34. Install the timing chain and the camshaft timing gear as follows:
    a. Install the timing chain on the camshaft timing gear with the bright link aligned with the timing mark on the camshaft timing gear.
    b. Install the timing chain on the crankshaft timing gear with the other bright link aligned with the timing mark on the crankshaft timing gear.
    c. Tie the timing chain with a cord to make sure that it doesn't come loose.
35. Install the timing chain cover.
36. Remove the cord from the chain.
37. Install the drive belt idler pulley and tighten the bolt to 32 ft. lbs. (43 Nm).
38. Install the crankshaft pulley. Align the pulley set key with the key groove of the pulley and slide on the pulley. Install the pulley bolt and tighten to 304 ft. lbs. (412 Nm).
39. Install the No. 1 and the No. 2 oil pans.
40. Install the bolts holding the No. 1 oil pan to the transmission housing. Tighten the bolts to 53 ft. lbs. (72 Nm).
41. Install the oil level sensor with a new gasket and tighten the bolts to 48 in. lbs. (5 Nm).
42. Connect the oil cooler pipe bracket to the No. 1 oil pan.
43. Install the cylinder head.
44. Install the water pump and tighten the bolts to 15 ft. lbs. (21 Nm).
45. Connect the No. 2 radiator hose to the water inlet. Install the nuts holding the radiator pipe to the No. 1 oil pan and tighten to 15 ft. lbs. (21 Nm).
46. Install the A/C compressor bracket and tighten the bolts to 27 ft. lbs. (37 Nm).
47. Install the A/C compressor and tighten the bolts to 18 ft. lbs. (25 Nm). Install and adjust the drive belt.
48. Install the radiator.
49. Refill the engine oil and the engine coolant.
50. Connect the negative battery cable.
51. Start the engine, check for leaks, and check the ignition timing.
52. Install the engine under cover.

Camshaft Sprockets or Pulleys

REMOVAL & INSTALLATION

22R and 22R-E Engines

◆ See Figures 292, 293, 294, 295, 296 and 297

The cam sprocket is removed from the camshaft as part of the rocker assembly removal. If the sprocket is to be removed from the chain, support the chain with a piece of wood, keeping the chain engaged to the lower sprocket. If the chain comes off the bottom sprocket, the timing chain covers must be removed and the chain correctly installed. Refer to Timing Chain Removal and Installation in this section.

1. Remove the valve cover.
2. Turn the crankshaft until the No. 1 cylinder position is set at TDC compression. Matchmark the sprocket and chain.
3. Remove the halfmoon plug from the front of the cylinder head.
4. Unbolt the cam sprocket.
5. Remove the distributor drive gear and camshaft thrust plate.
6. Remove the cam sprocket. Using a piece of wire, support the chain to keep it in position for sprocket installation.

To install:

7. While holding up on the sprocket and chain, turn the crankshaft until No. 1 and No. 4 cylinders reach TDC.
8. Place the sprocket over the camshaft dowel. If the chain does not seem long enough on replacement, turn the crankshaft back and forth while pulling up on the chain and sprocket.

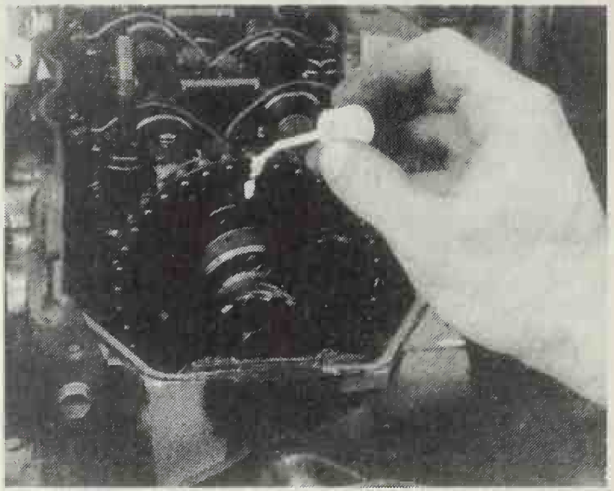

Fig. 292 Matchmark the chain and sprocket

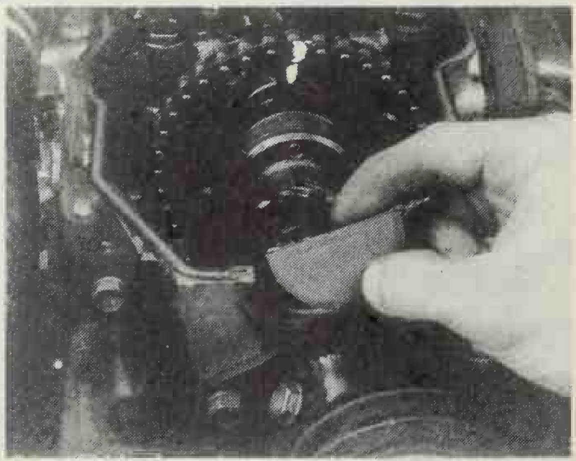

Fig. 293 Remove the halfmoon plug located at the front of the cylinder head

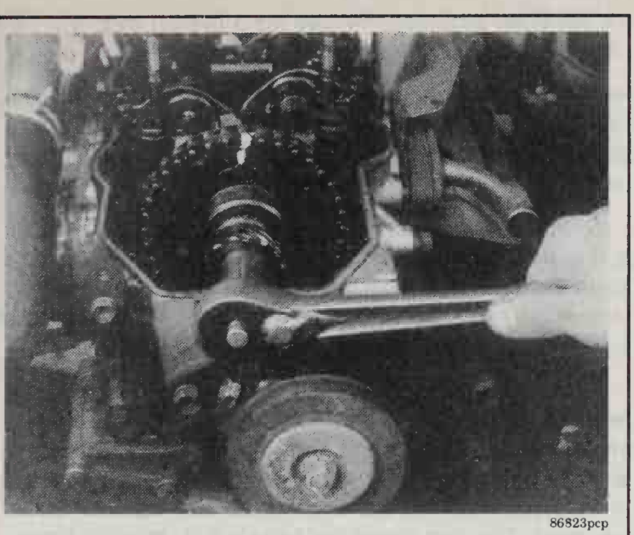
86823pcp

Fig. 294 Loosen and remove the drive gear bolt

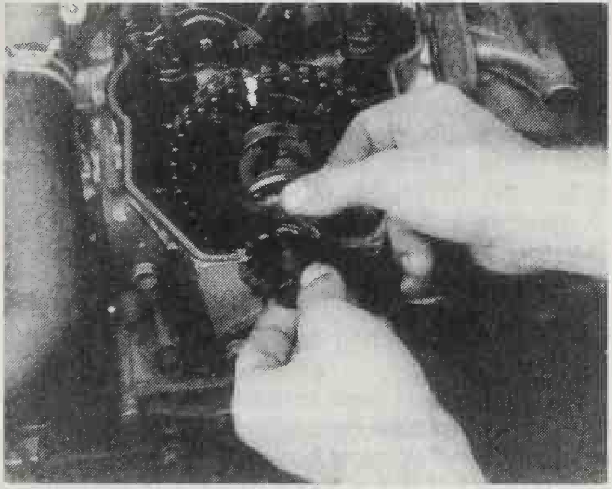
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Fig. 295 Pull the bolt and gear off the cam

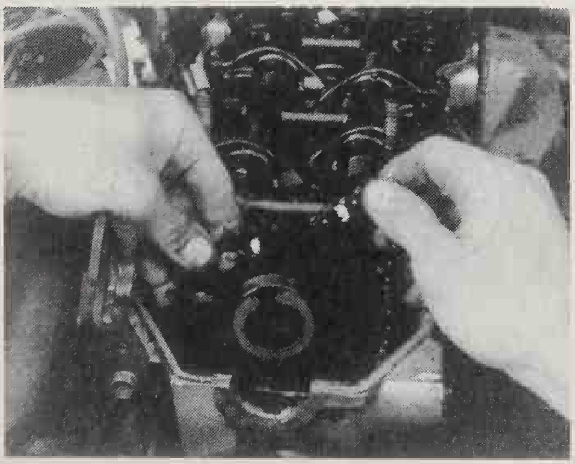
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Fig. 296 Lift the chain up, then slide the gear off the cam

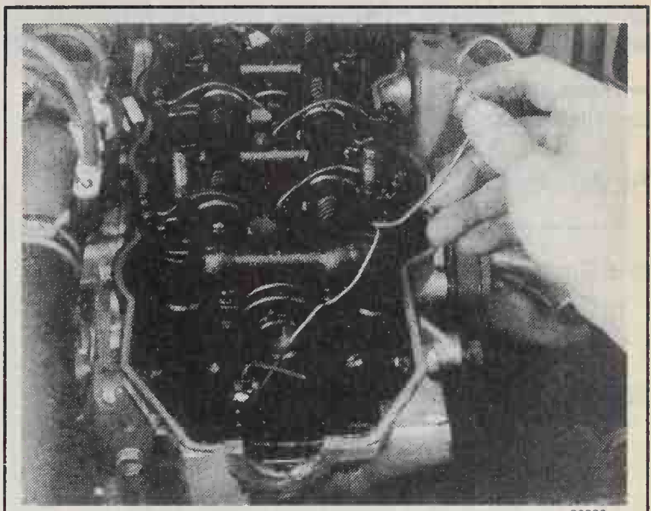
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Fig. 297 Secure the chain in place with a length of wire

9. Place the distributor drive gear and camshaft thrust plate over the chain sprocket. Tighten the bolt to 58 ft. lbs. (78 Nm).
10. Install the halfmoon plug on the cylinder head.
11. Install the valve cover.

3VZ-E Engines

1. Remove the timing belt.
2. Use a properly installed counter-holding tool, remove the pulley bolt, the pulley and the match pin. Note that the left and right pulleys are different; label them to avoid confusion at reassembly.

✲✲WARNING

Do not attempt to use the timing belt to hold tension on the pulley while loosening or tightening the retaining bolt.

To install:

3. Align the camshaft match pin hole with the marks on the upper rear timing belt cover. This places the pin holes straight up.
4. Install the timing pulleys, observing correct placement of the left and right pulleys. Install the bolts, but do not install the match pin. Check that the bolt head is not touching the pulley (Its not completely tight yet). Align the timing mark on each pulley with the marks on the No. 3 timing cover.
5. Install the timing belt, following the procedures given in this section. After the engine has been rotated two full revolutions and the timing marks checked, tighten the idler pulley bolt.
6. Remove the camshaft timing pulley bolts. Align the pulley match pin hole with the hole in the camshaft; install the match pin. Reinstall the camshaft pulley bolts.
7. Using a properly installed counter-holding tool, tighten the pulley bolts to 80 ft. lbs. (108 Nm). Take great care not to nick or damage the timing belt.
8. Continue with the re-installation of the timing belt.

Camshaft and Bearings

➡These engines are not equipped with replaceable camshaft bearings.

REMOVAL & INSTALLATION

3F-E Engines

To service the camshaft on these engines, please refer to the Timing Gear Removal and Installation procedure.

22R, 22R-E and 3VZ-E

1. Perform the Cylinder Head Removal procedure (for your engine) far enough to gain access to the camshaft bearing cap bolts. If you are going to remove the head anyway, remove the cam after removing the cylinder head.
2. Prior to removing the camshaft, measure its end-play with a feeler gauge. Consult the Camshaft Specifications Chart for the correct end-play. If the end-play is beyond this, replace the head.
3. Remove the bearing cap bolts. Remove the caps. Keep them in order, or mark them.
4. Measure the bearing oil clearance by placing a piece of Plastigage® on each journal. Replace the caps and tighten their bolts to 13-16 ft. lbs. (18-22 Nm).
5. Remove the caps and measure each piece of Plastigage®. If the clearance is greater than 2 in. (0.1mm), replace the head and cam.
6. Lift the camshaft out of the head.

To install:

7. Coat all of the camshaft bearing journals with engine oil.
8. Lay the camshaft in the head.
9. Install the bearing caps in numerical order with their arrows pointing forward (toward the front of the engine) on 4 cylinder engines. On the 3VZ-E, the right bank arrows point forward with No. 1 cap at the front of the engine. The left bank arrows point to the rear with the No. 1 cap at the rear.
10. Install the cap bolts and tighten them in three passes and in the correct order, to 13-16 ft. lbs. (18-22 Nm).
11. Complete the cylinder head installation procedure and/or valve rocker installation.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 298, 299, 300, 301 and 302

1. Remove the timing chain from the engine.
2. Remove the exhaust camshaft by bringing the service bolt hole of the driven sub-gear upwards. Turn the hexagon wrench head portion of the exhaust camshaft with a wrench.
3. Secure the exhaust camshaft sub-gear to the main gear with a service bolt. The thread diameter should be 0.23 in. (6mm) with a thread pitch of 0.04 in. (1.0mm) and a bolt length of 0.63-0.79 in. (16-20mm).

➡When you remove the camshaft, be sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

4. Uniformly loosen and remove the exhaust bearing cap bolts (10 of them), in several passes. Use the reverse order of the tightening sequence. Remove the 5 bearing caps and the camshaft. Do the same for the intake camshafts.

➡If the camshaft is not being lifted out straight and level, reinstall the No. 3 cap with the 2 bolts. Alternately loosen then remove the bearing cap bolts with the camshaft pulled up. Do not pry on or force the camshaft.

5. Inspect the camshafts for runout. Inspect the cam lobes and journals. The bearings are part of the cam and should be inspected for flaking or scoring. If the bearings are damaged, replace the caps and the cylinder head as a set. The camshaft journal oil and thrust clearances should be checked.

To install:

➡When installing the camshafts; since the thrust clearance of the shafts is small, the cam must be kept level while it is being installed. If it is not kept level, the portion of the head receiving the shaft thrust may crack or be damaged. This can cause the camshaft to seize or break.

6. Install the intake camshaft as follows:
   a. Apply multi-purpose grease to the thrust portion of the intake camshaft.
   b. Position the intake camshaft with the pin facing upward.
   c. Install the bearing caps in their proper locations. Apply a light coat of engine oil to the threads and install the cap bolts. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).
7. Install the exhaust camshaft as follows:
   a. Apply engine oil to the thrust portion of the intake camshaft.
   b. Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks (one and two dots) on each other.
   c. Roll down the exhaust camshaft onto the bearing journals while engaging the gears with each other. Install the bearing caps in their proper locations.
   d. Apply a light coat of engine oil to the threads and install the cap bolts. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).

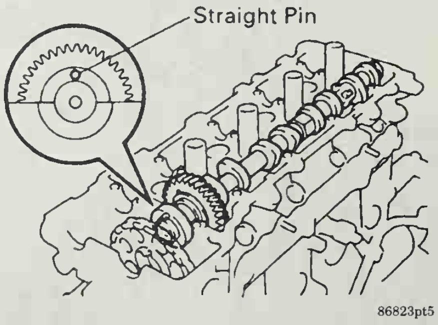


Fig. 298 Install the camshaft with the pin facing upwards

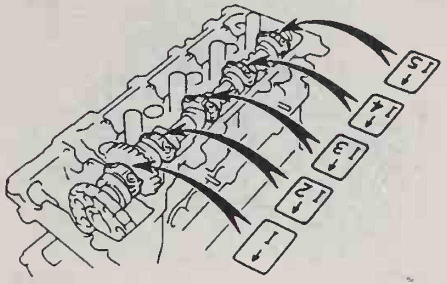


Fig. 299 Intake camshaft bearing cap locations

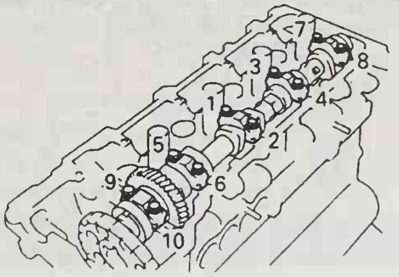


Fig. 300 Tighten the intake bearing caps following this order

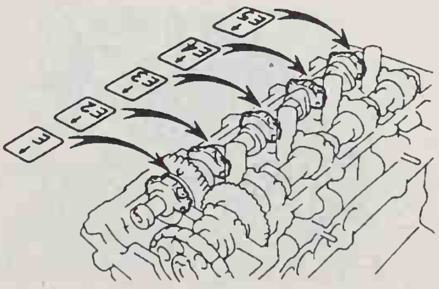


Fig. 301 Position the exhaust camshaft bearing caps as shown

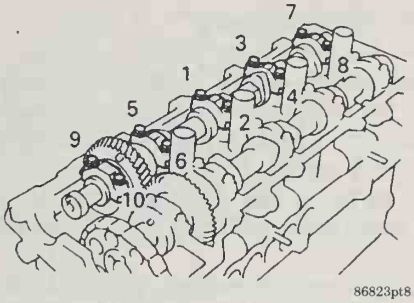


Fig. 302 Tighten the exhaust bearing cap bolts in this order

e. Remove the service bolt from the driven sub-gear. Check that the intake and exhaust camshafts turn smoothly.

8. Set No. 1 cylinder to TDC compression stroke. The crankshaft pulley groove aligns with the **0** mark on timing cover and camshaft timing marks with one dot and two dots will be in a straight line on the cylinder head surface.

9. Install the timing gear. Place the gear over the straight pin of the intake camshaft.

a. Hold the intake camshaft with a wrench. Install and tighten the bolt to 54 ft. lbs. (74 Nm).

b. Hold the exhaust camshaft and install the bolt and distributor gear. Tighten the bolt to 34 ft. lbs. (46 Nm).

10. Install the chain tensioner, using a new gasket (mark toward the front) as follows:

a. Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

b. Turn the crankshaft pulley clockwise to provide some slack for the chain on the tensioner side.

c. Push the tensioner by hand until it touches the head installation surface, then install the 2 nuts. Tighten the nuts to 13 ft. lbs. (18 Nm). Check that the hook of the tensioner is not released.

d. Turn the crankshaft to the left so that the hook of the chain tensioner is released from the pin of the plunger, allowing the plunger to spring out and the slipper to be pushed into the chain.

11. Check and adjust the valve clearance. Intake valve clearance is 0.006-0.010 inch (0.15-0.25 mm) and exhaust valve clearance is 0.010-0.014 inch (0.25-0.35 mm).

12. Recheck the engine for proper valve timing. Check and adjust the valve clearance.

13. Install the spark plugs and the semi-circular plug.

14. Recheck the engine for proper valve timing. Install the valve cover and engine hangers. Tighten the engine hanger bolts to 30 ft. lbs. (42 Nm).

15. Reinstall all other parts from the timing chain removal. Fill any fluids, start the engine, top off the fluids.

5VZ-FE Engine

➧ See Figures 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315 and 316

1. Remove both valve covers.
2. Remove the semi-circular plugs.
3. Remove the right exhaust camshaft as follows:
   a. Bring the service bolt hole of the driven sub-gear upward by turning the hexagon head portion of the exhaust camshaft with a wrench.
   b. Align the timing mark (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.
   c. Secure the exhaust camshaft sub-gear to the driven gear with a service bolt 0.2 in. (6mm) diameter, 0.6 in. (16-20mm) bolt length and 0.4 in. (1.0mm) in thread pitch.

➡When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

   d. Uniformly loosen and remove the bearing cap bolts in several passes, in the sequence shown.
   e. Remove the bearing caps and camshaft. Make a note of the bearing cap positions for proper installation.

⁂WARNING

Do not pry on or attempt to force the camshaft with a tool or other object.

4. Remove the right hand intake camshaft as follows:
   a. Uniformly loosen and remove the bearing cap bolts in several passes, in the sequence shown.
   b. Remove the bearing caps, oil seal and camshaft. Make a note of the bearing cap positions for proper installation.
5. Remove the left exhaust camshaft as follows:
   a. Align the timing mark (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

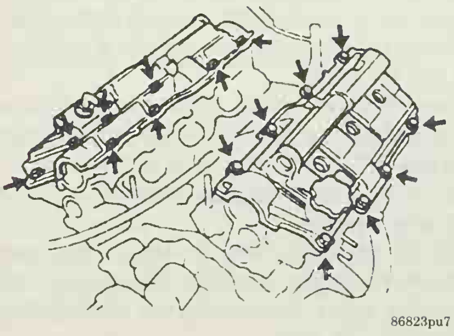


Fig. 303 Remove the valve covers from the engine

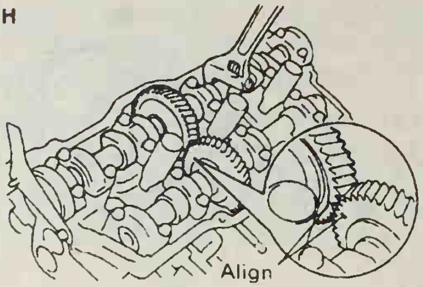


Fig. 304 Align the gears by turning the camshaft with a wrench on the flats provided — not the lobes

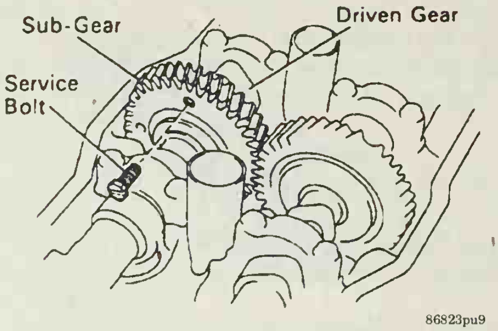


Fig. 305 Use an appropriate size bolt to release the spring force of the sub-gear

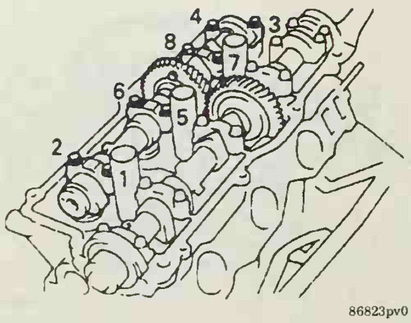


Fig. 306 Right hand exhaust camshaft bearing cap loosening sequence

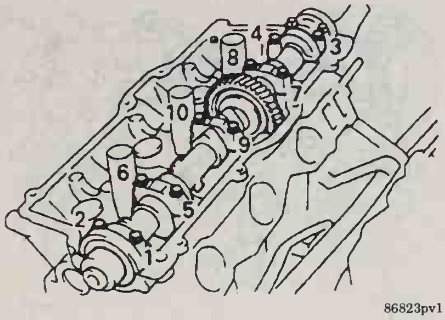


Fig. 307 Loosen the right hand intake camshaft caps as shown

b. Secure the exhaust camshaft sub-gear to the driven gear with a service bolt 0.2 in. (6mm) diameter, 0.6 in. (16-20mm) bolt length and 0.4 in. (1.0mm) in thread pitch.

➡When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

c. Uniformly loosen and remove the bearing cap bolts in several passes, in the sequence shown.

d. Remove the bearing caps and camshaft. Make a note of the bearing cap positions for proper installation.

⁂WARNING

Do not pry on or attempt to force the camshaft out.

6. Remove the left hand intake camshaft as follows:

a. Uniformly loosen and remove the bearing cap bolts in several passes, in the sequence shown.

b. Remove the bearing caps, oil seal and camshaft. Make a note of the bearing cap positions for proper installation.

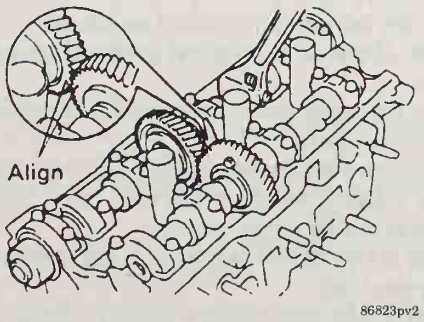


Fig. 308 When aligning the gears, turn the camshaft with the flats provided. Do not place a wrench on the lobes

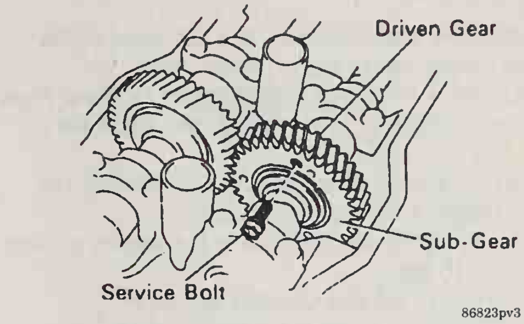


Fig. 309 The spring force of the sub-gear can be overcome by using an appropriate sized bolt

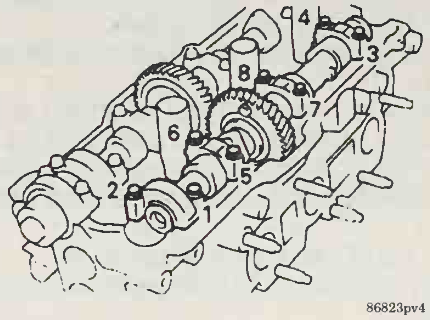


Fig. 310 Left hand exhaust camshaft bearing cap loosening sequence

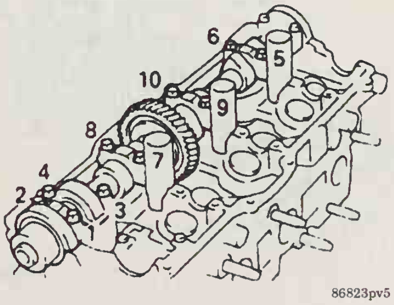


Fig. 311 The left hand intake camshaft caps must be loosened as shown

To install:

7. Install the right intake camshaft as follows:

a. Apply engine oil to the thrust portion of the intake camshaft.

b. Position the intake camshaft at a 90° angle of the timing mar (2 dot marks) on the cylinder head.

c. Install the bearing caps in their proper locations. Apply a light coat of engine oil to the threads and install the cap bolts.

d. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

e. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).

8. Install the right exhaust camshaft as follows:

a. Apply engine oil to the thrust portion of the intake camshaft.

b. Align the timing marks (2 dot marks) of the camshaft drive and driven gears.

c. Roll down the exhaust camshaft onto the bearing journals while engaging the gears with each other. Install the bearing caps in their proper locations.

d. Apply a light coat of engine oil to the threads and install the cap bolts.

e. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

f. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).

g. Remove the service bolt from the driven sub-gear. Check that the intake and exhaust camshafts turns smoothly.

h. Align the timing marks (2 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

9. Install the left intake camshaft as follows:

a. Apply engine oil to the thrust portion of the intake camshaft.

b. Position the intake camshaft at a 90° angle of the timing mar (1 dot marks) on the cylinder head.

c. Install the bearing caps in their proper locations. Apply a light coat of engine oil to the threads and install the cap bolts.

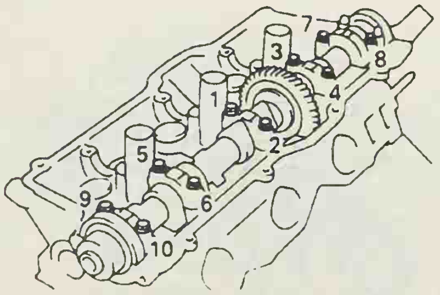


Fig. 312 Tighten the right side intake camshaft caps as shown

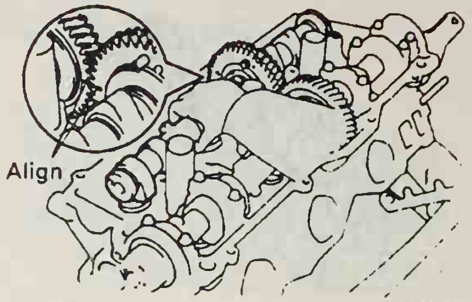


Fig. 313 When installing the exhaust camshaft, make sure the timing marks align

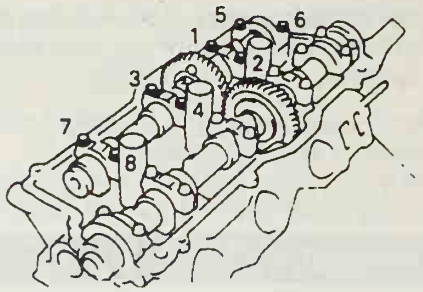


Fig. 314 Use this sequence to tighten the right hand exhaust camshaft bearing cap bolts

d. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

e. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).

10. Install the left exhaust camshaft as follows:

a. Apply engine oil to the thrust portion of the intake camshaft.

b. Align the timing marks (1 dot marks) of the camshaft drive and driven gears.

c. Roll down the exhaust camshaft onto the bearing journals while engaging the gears with each other. Install the bearing caps in their proper locations.

d. Apply a light coat of engine oil to the threads and install the cap bolts.

e. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

f. Uniformly tighten the cap bolts in the sequence shown to 12 ft. lbs. (16 Nm).

g. Remove the service bolt.

11. Check and adjust the valve clearance.

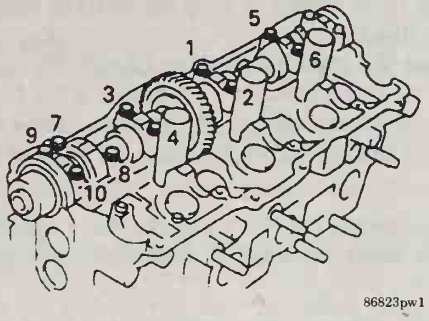


Fig. 315 Tightening sequence for the left hand intake camshaft cap bolts

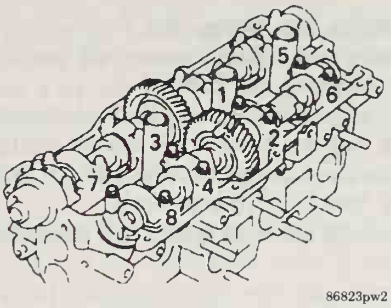


Fig. 316 Tighten the left side exhaust camshaft cap bolts in this sequence

12. Install the semi-circular plugs.
13. Install the cylinder head covers. Uniformly tighten the bolts in several passes to 53 inch lbs. (6 Nm).

1FZ-FE Engine

▸ See Figures 317, 318, 319 and 320

1. Remove the valve cover.
2. Remove the semi-circular plug from the cylinder head.
3. Remove the spark plugs.
4. Set the No. 1 cylinder to TDC of the compression stroke as follows:
   a. Turn the crankshaft pulley and align its groove with the 0 mark on the timing chain cover.
   b. Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface. If not, turn the crankshaft one revolution (360°) and align the marks.
5. Remove the chain tensioner.

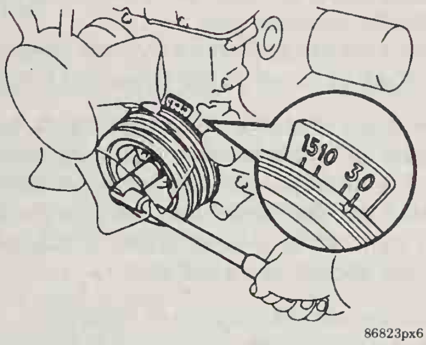


Fig. 317 Turn the crankshaft pulley and align its groove with the 0 mark on the timing chain cover

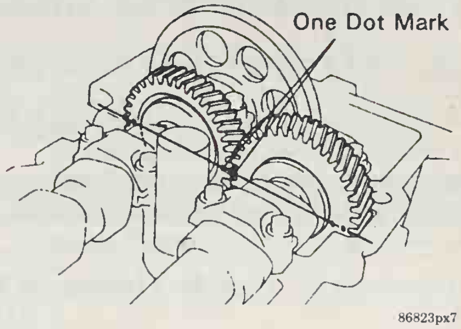


Fig. 318 Check that the marks on the camshaft pulley are aligned

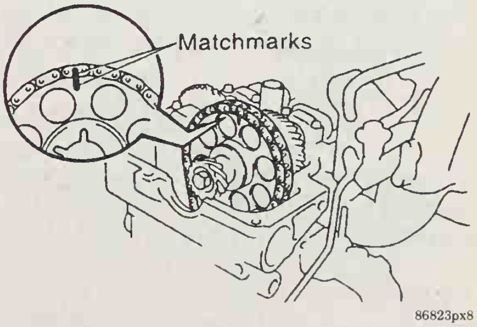


Fig. 319 Matchmark the position of the chain on the gear

6. Place matchmarks on the camshaft timing gear and the timing chain and remove the camshaft timing gear.

a. Hold the intake camshaft with a wrench and remove the bolt and the distributor gear.

b. Remove the camshaft timing gear and chain from the intake camshaft and leave on the slipper and the damper.

➡Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

7. Remove the exhaust camshaft as follows:

a. Bring the service bolt hole of the driven sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

b. Secure the exhaust camshaft sub-gear to the main gear with a service bolt. When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

c. Set the timing mark (two dot marks) of the camshaft driven gear at approximately a 35° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.

d. Lightly push the camshaft towards the rear without applying excessive force.

e. Loosen and remove the No. 1 bearing cap bolts, alternately loosening the left and right bolts uniformly.

f. Loosen and remove the No. 2, No. 3, No. 5 and the No. 7 bearing cap bolts, alternately loosening the left and right bolts uniformly in several passes, in sequence.

➡Do not remove the No. 4 and No. 6 bearing cap bolts at this stage.

g. Remove the four bearing caps.

h. Alternately and uniformly loosen and remove the No. 4 and the No. 6 bearing cap bolts.

i. If the camshaft is not being lifted out straight and level, retighten the four No. 4 and No. 6 bearing cap bolts. Then reverse the order of the above steps from (g) to (e) and repeat steps from (c) to (h) once again.

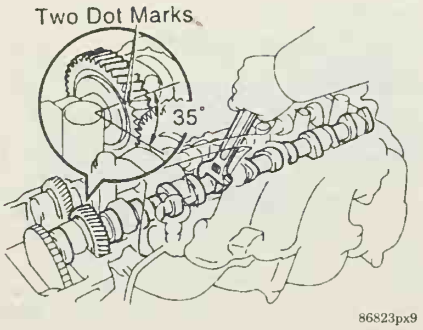


Fig. 320 Turn the camshaft by using the flats provided. Do not use the lobes

j. Remove the two bearing caps and exhaust camshaft. Do not pry on or attempt to force the camshaft with a tool or any other object.

8. Remove the intake camshaft as follows:

a. Set the timing mark (two dot marks) of the camshaft drive gear at approximately a 25° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.

➡This angle allows the No. 1 and the No. 4 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

b. Lightly push the intake camshaft towards the front without applying excessive force.

c. Loosen and remove the No. 1 bearing cap bolts, alternately loosening the left and the right bolts uniformly.

d. Loosen and remove the No. 3, No. 4, No. 6 and the No. 7 bearing cap bolts, alternately loosening the left and right bolts uniformly in several passes in sequence.

➡Do not remove the No. 2 and No. 5 bearing cap bolts at this stage.

e. Remove the four bearing caps.

f. Alternately and uniformly loosen and remove the No. 2 and the No. 5 bearing cap bolts.

g. If the camshaft is not being lifted out straight and level, retighten the four No. 2 and No. 5 bearing cap bolts. Then reverse the order of the above steps from (e) to (c) and repeat steps from (a) to (f) once again.

h. Remove the two bearing caps and the exhaust camshaft.

To install:

9. Install the intake camshaft as follows:

➡Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

a. Apply engine oil to the thrust portion of the intake camshaft.

b. Lightly place the intake camshaft on top of the cylinder head so that the No. 1 and the No. 4 cylinder cam lobes face downward.

c. Lightly push the camshaft towards the front without applying excessive force. Place the No. 2 and the No. 5 bearing caps in their proper location.

d. Temporarily tighten these bearing cap bolts uniformly and alternately in several passes until the bearing caps are snug with the cylinder head.

e. Place the No. 3, No. 4, No. 6, and the No. 7 bearing caps in their proper location. Temporarily tighten these bearing cap bolts, alternately tightening the left and right bolts uniformly.

f. Place the No. 1 bearing cap in its proper location. Check that there is no gap between the cylinder head and the contact surface of the bearing cap.

g. Uniformly tighten the 14 bearing cap bolts in several passes to 12 ft. lbs. (16 Nm).

10. Install the exhaust camshaft as follows:
   a. Set the timing mark (two dot marks) of the camshaft drive gear at approximately 35° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.
   b. Apply engine oil to the thrust portion of the exhaust camshaft. Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks (two dot marks) on each gear.
   c. Roll down the exhaust camshaft onto the bearing journals while engaging the gears with each other. Lightly push the intake camshaft towards the front without applying excessive force.
   d. Install the No. 4 and the No. 6 bearing caps in their proper location. Temporarily tighten these bearing cap bolts, alternately tightening the left and right bolts uniformly.
   e. Place the No. 2, No. 3, No. 5, and the No. 7 bearing caps in their proper location. Temporarily tighten these bearing cap bolts, alternately tightening the left and right bolts uniformly.
   f. Tighten the 14 bearing cap bolts in several passes to 12 ft. lbs. (16 Nm).
   g. Bring the service bolt installed in the driven sub-gear upward by turning the hexagon wrench head portion of the camshaft with a wrench. Remove the service bolt.
   h. Check that the intake and the exhaust camshafts turn smoothly.
11. Set the No. 1 cylinder to TDC of the compression stroke as follows:
   a. Turn the crankshaft pulley, and align its groove with the timing mark **0** of the timing chain cover. Turn the camshaft so that the timing marks with one and two dots will be in straight line on the cylinder head surface.
12. Install the camshaft timing gear as follows:
   a. Check that the matchmarks on the camshaft timing gear and the timing chain are aligned. Place the gear over the straight pin of the intake camshaft.
   b. Align the straight pin of the distributor gear with the straight pin groove of the intake camshaft gear.
   c. Hold the intake camshaft with a wrench, install and tighten the bolt to 54 ft. lbs. (74 Nm).
13. Install the chain tensioner. Push the tensioner by hand until it touches the head installation surface, then install and tighten the two nuts to 15 ft. lbs. (21 Nm).
14. Check the valve timing as flows:
   a. Turn the crankshaft pulley, and align its groove with the timing mark **0** of the timing chain cover. Always turn the crankshaft clockwise.
   b. Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface. If not, turn the crankshaft one revolution (360°) and align the marks.
15. Check valve clearance and adjust if necessary.
16. Install the spark plugs.
17. Install the semi-circular plug to the cylinder head.
18. Make sure that the No. 1 cylinder is in TDC of the compression stroke.
19. Install the valve cover.

INSPECTION

A dial indicator, micrometer and inside micrometer are all needed to properly measure the camshaft and camshaft housing. If these instruments are available, proceed; if they are not available, have the parts checked at a reputable machine shop. Camshaft specifications are included in the Camshaft Specifications chart in this section.

1. Using the micrometer, measure the height of each cam lobe. If a lobe height is less than the minimum specified, the lobe is worn and the cam must be replaced.
2. Place the cam in V-blocks and measure its run-out at the center journal with a dial indicator. Replace the cam if run-out exceeds:
   - 22R and 22R-E — 0.0078 in. (0.20mm)
   - 3F-E — 0.0118 in. (0.30mm)
   - All others — 0.0024 in. (0.06mm)
3. Using the micrometer, measure journal diameter, jot down the readings and compare the readings with those listed in the Camshaft Specifications chart. Measure the housing bore inside diameter with the inside micrometer, and jot the measurements down. Subtract the journal diameter measurement from the housing bore measurement. If the clearance is greater than the maximum listed under Bearing Clearance in the chart, replace the camshaft and/or the housing.

Pistons and Connecting Rods

➧ See Figures 321, 322, 323, 324, 325 and 326

REMOVAL

➧ See Figures 327 and 328

➡This procedure requires removal of most of the engine parts, including the head and pan. While it can be performed in the vehicle, removing the engine from the vehicle makes the job much easier. Mount the engine on an engine stand so that it may be rotated or moved about the work area. Before removing the piston assemblies, connecting rod bearing clearance and side clearance should be checked. Refer to the Connecting Rod Inspection procedure in this section.

1. Remove the cylinder head.
2. Remove the oil pan and pump.
3. Position a cylinder ridge reamer into the top of the cylinder bore. Keeping the tool square, ream the ridges from the top of the bore. Clean out the ridge material with a solvent-soaked rag, or blow it out with compressed air.
4. Remove the oil strainer. Use a numbered die set to mark each cap and connecting rod with its cylinder number. Unbolt the connecting rod caps.
5. Place pieces of rubber hose over the rod bolts, to protect the cylinder walls and crank journals from scratches. Push the connecting rod and piston up and out of the cylinder from

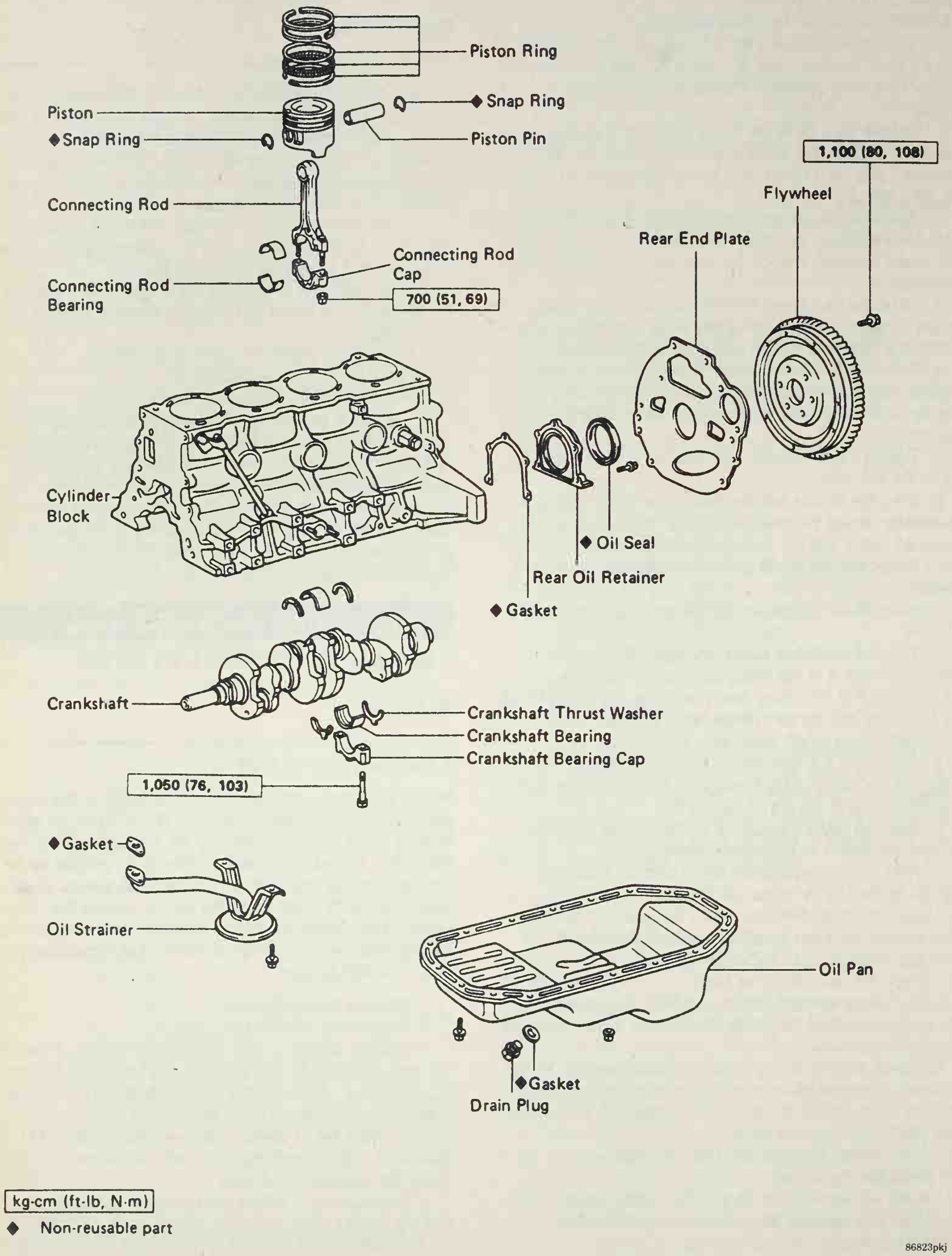

Piston Ring
Piston
◆Snap Ring
◆Snap Ring
Piston Pin
1,100 (80, 108)
Flywheel
Connecting Rod
Rear End Plate
Connecting Rod Cap
Connecting Rod Bearing
700 (51, 69)
Cylinder Block
◆Oil Seal
Rear Oil Retainer
◆Gasket
Crankshaft
Crankshaft Thrust Washer
Crankshaft Bearing
Crankshaft Bearing Cap
1,050 (76, 103)
◆Gasket
Oil Strainer
Oil Pan
◆Gasket
Drain Plug
kg-cm (ft-lb, N·m)
◆ Non-reusable part
86823pkj

Fig. 321 Exploded view of the 22R and 22R-E engine block

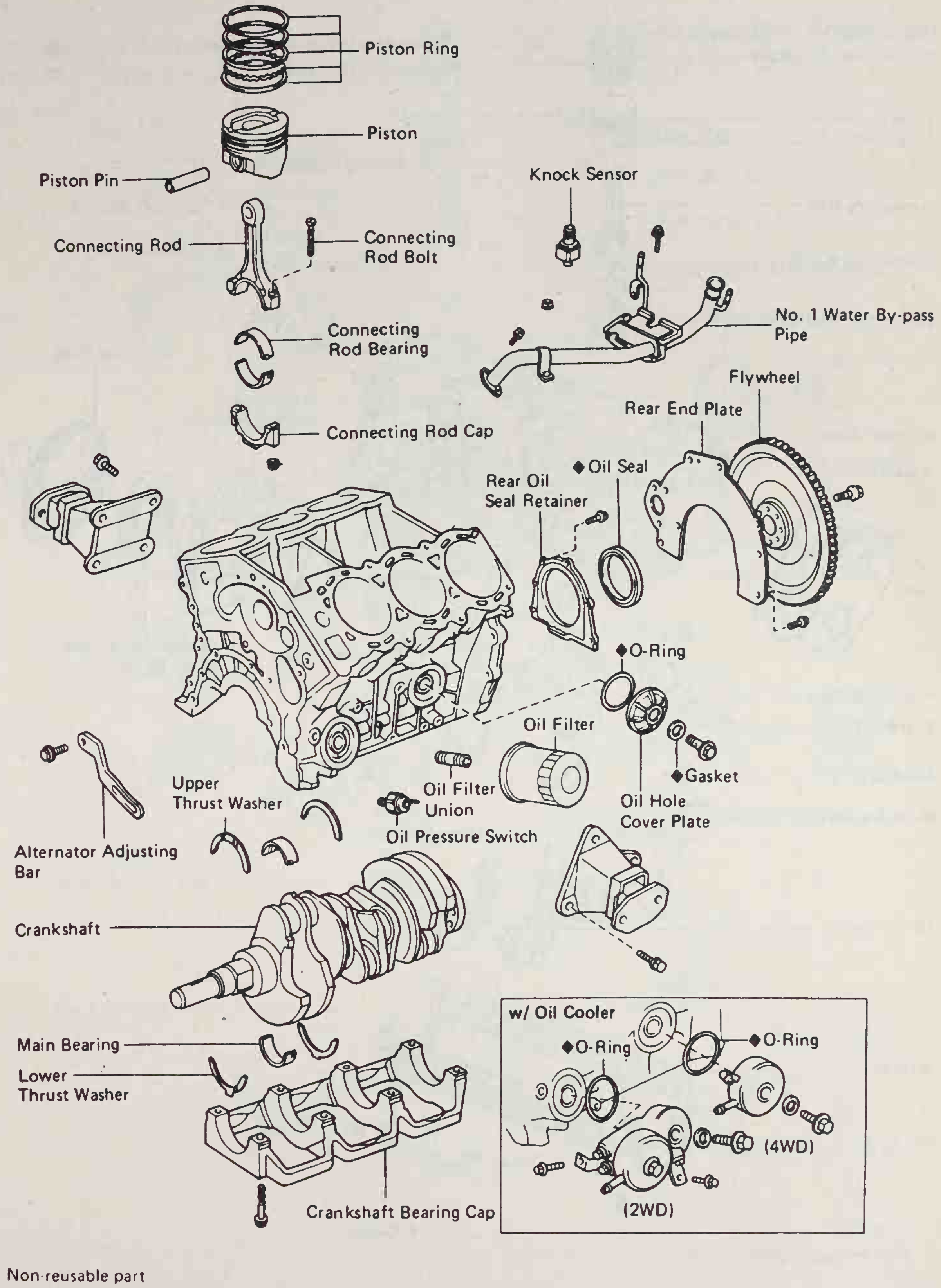

Piston Ring
Piston
Piston Pin
Connecting Rod
Connecting Rod Bolt
Connecting Rod Bearing
Connecting Rod Cap
Knock Sensor
No. 1 Water By-pass Pipe
Flywheel
Rear End Plate
◆Oil Seal
Rear Oil Seal Retainer
◆O-Ring
Oil Filter
◆Gasket
Oil Hole Cover Plate
Oil Filter Union
Oil Pressure Switch
Upper Thrust Washer
Alternator Adjusting Bar
Crankshaft
Main Bearing
Lower Thrust Washer
Crankshaft Bearing Cap
w/ Oil Cooler
◆O-Ring
◆O-Ring
(4WD)
(2WD)
◆ Non-reusable part
86823pkl

Fig. 322 Exploded view of the 3VZ-E engine block

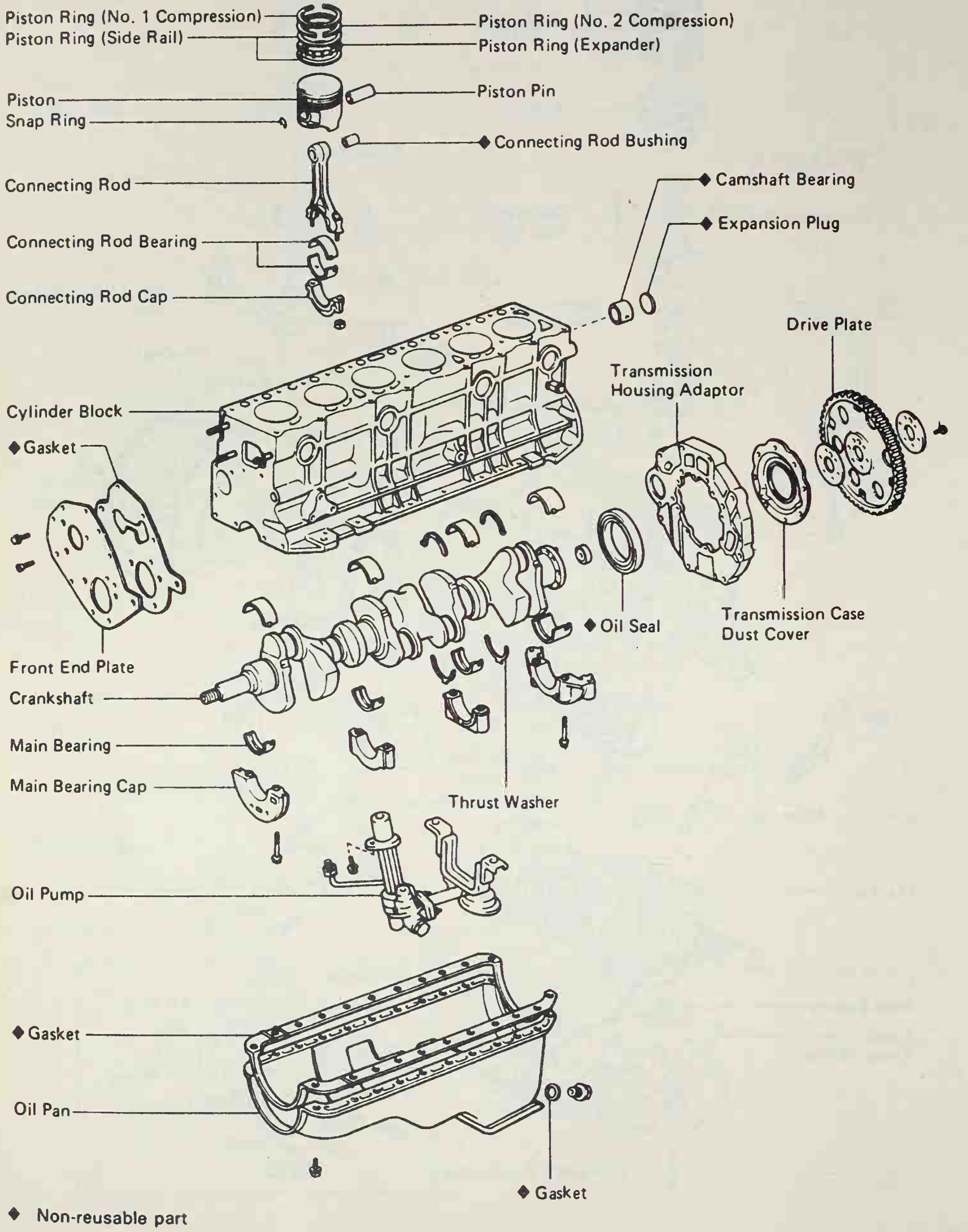

Piston Ring (No. 1 Compression)
Piston Ring (Side Rail)
Piston Ring (No. 2 Compression)
Piston Ring (Expander)
Piston
Snap Ring
Piston Pin
◆ Connecting Rod Bushing
Connecting Rod
◆ Camshaft Bearing
◆ Expansion Plug
Connecting Rod Bearing
Connecting Rod Cap
Drive Plate
Transmission Housing Adaptor
Cylinder Block
◆ Gasket
◆ Oil Seal
Transmission Case Dust Cover
Front End Plate
Crankshaft
Main Bearing
Main Bearing Cap
Thrust Washer
Oil Pump
◆ Gasket
Oil Pan
◆ Gasket
◆ Non-reusable part
86823pkm

Fig. 323 Exploded view of the 3F-E engine block

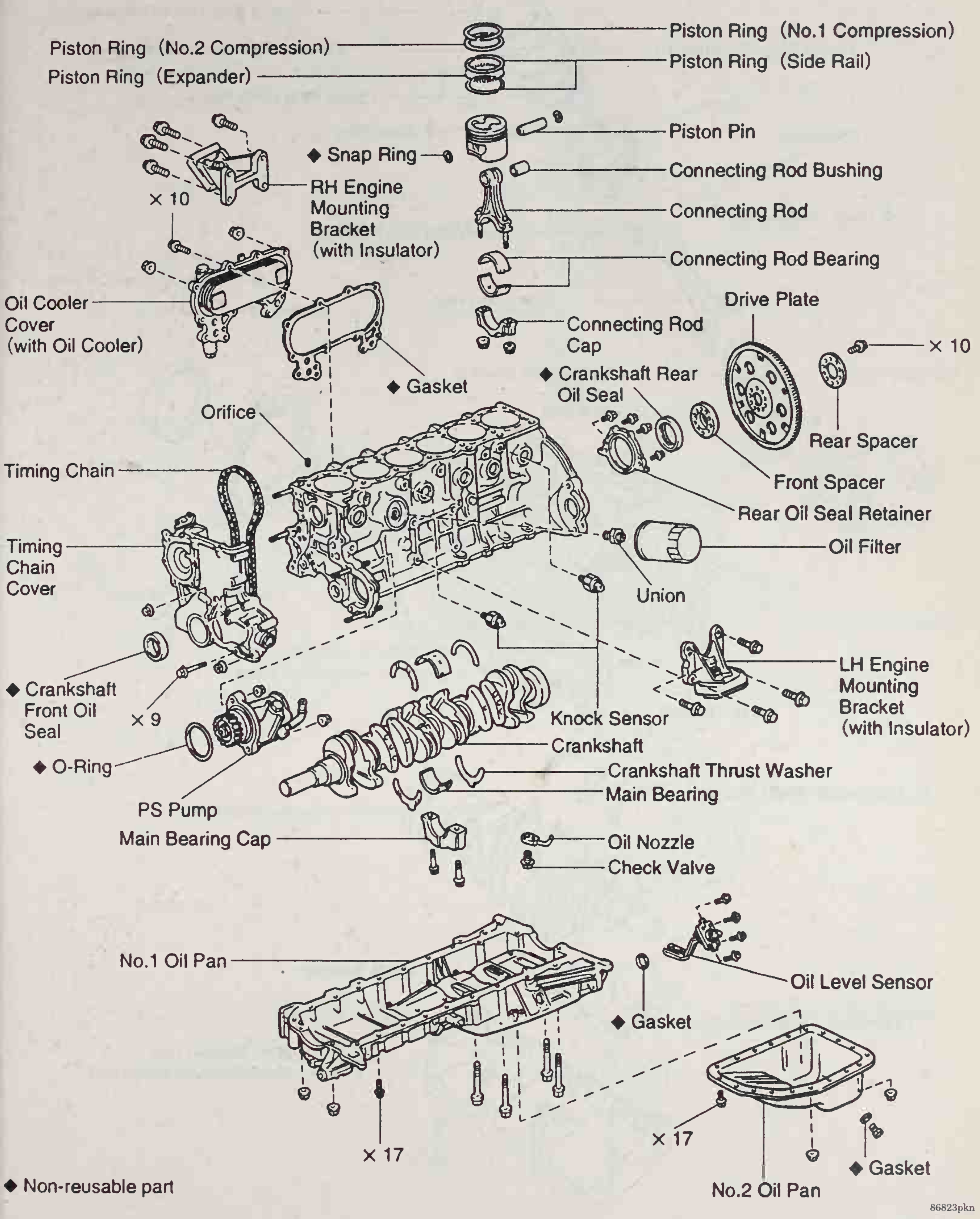

Piston Ring (No.2 Compression)
Piston Ring (Expander)
Piston Ring (No.1 Compression)
Piston Ring (Side Rail)
Piston Pin
◆ Snap Ring
Connecting Rod Bushing
RH Engine Mounting Bracket (with Insulator)
× 10
Connecting Rod
Connecting Rod Bearing
Oil Cooler Cover (with Oil Cooler)
Drive Plate
Connecting Rod Cap
× 10
◆ Crankshaft Rear Oil Seal
◆ Gasket
Orifice
Rear Spacer
Timing Chain
Front Spacer
Rear Oil Seal Retainer
Oil Filter
Timing Chain Cover
Union
LH Engine Mounting Bracket (with Insulator)
◆ Crankshaft Front Oil Seal
× 9
Knock Sensor
Crankshaft
◆ O-Ring
Crankshaft Thrust Washer
Main Bearing
PS Pump
Main Bearing Cap
Oil Nozzle
Check Valve
No.1 Oil Pan
Oil Level Sensor
◆ Gasket
× 17
× 17
◆ Gasket
No.2 Oil Pan
◆ Non-reusable part
86823pkn

Fig. 324 Exploded view of the 1FZ-FE engine block

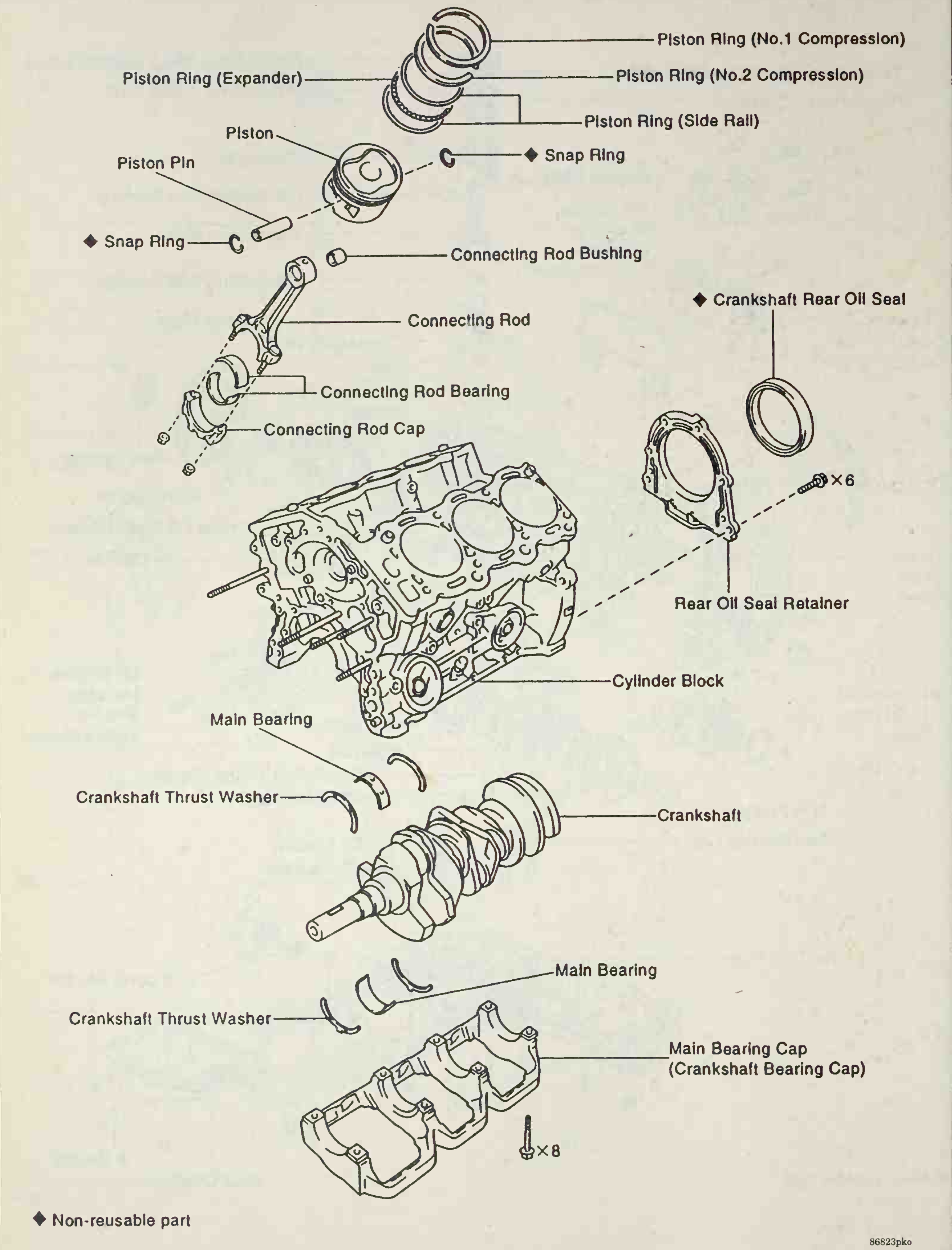

Piston Ring (No.1 Compression)
Piston Ring (Expander)
Piston Ring (No.2 Compression)
Piston Ring (Side Rail)
Piston
Piston Pin
◆ Snap Ring
◆ Snap Ring
Connecting Rod Bushing
◆ Crankshaft Rear Oil Seal
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
×6
Rear Oil Seal Retainer
Cylinder Block
Main Bearing
Crankshaft Thrust Washer
Crankshaft
Main Bearing
Crankshaft Thrust Washer
Main Bearing Cap
(Crankshaft Bearing Cap)
×8
◆ Non-reusable part
86823pko

Fig. 325 Exploded view of the 5VZ-FE engine block

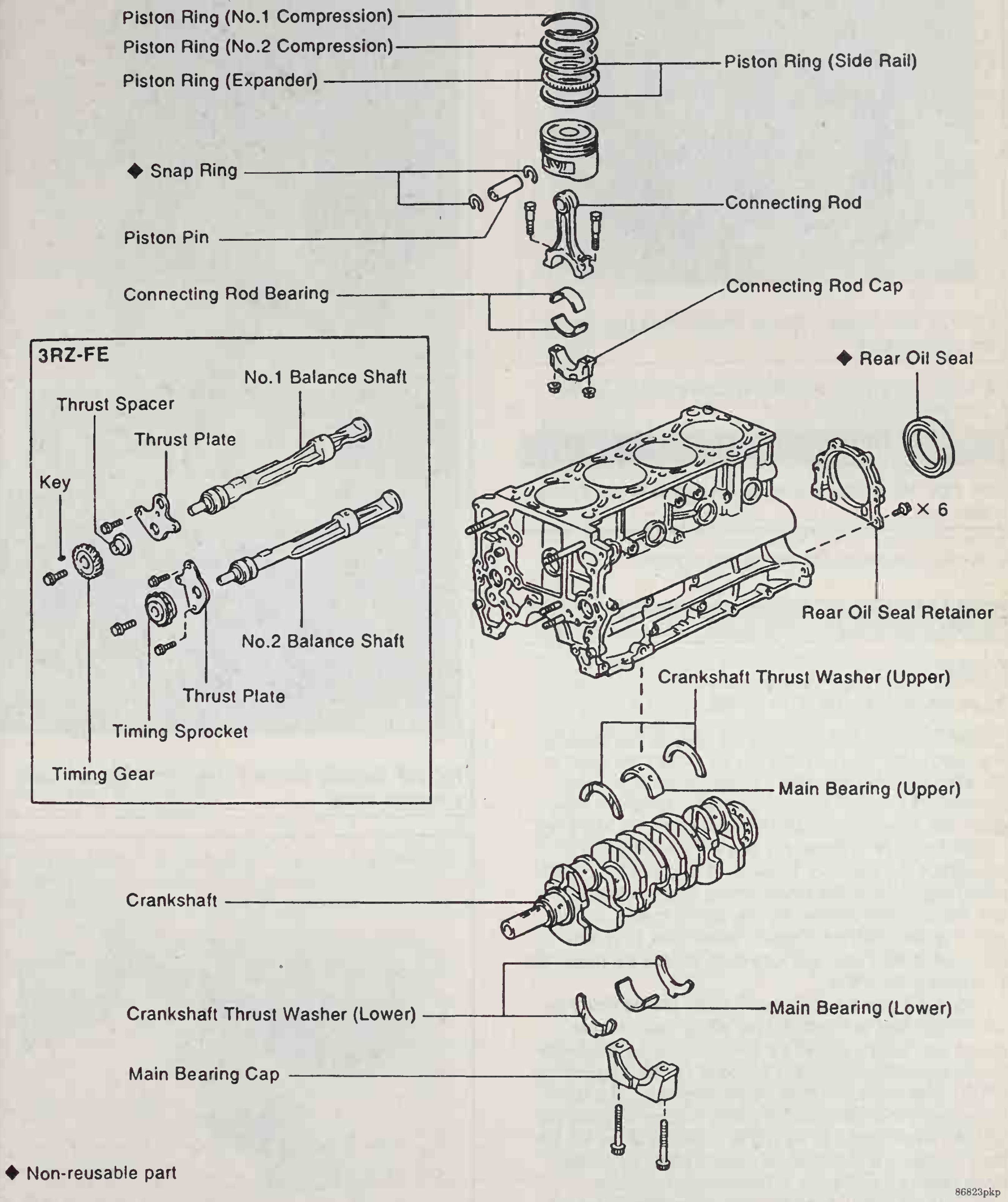
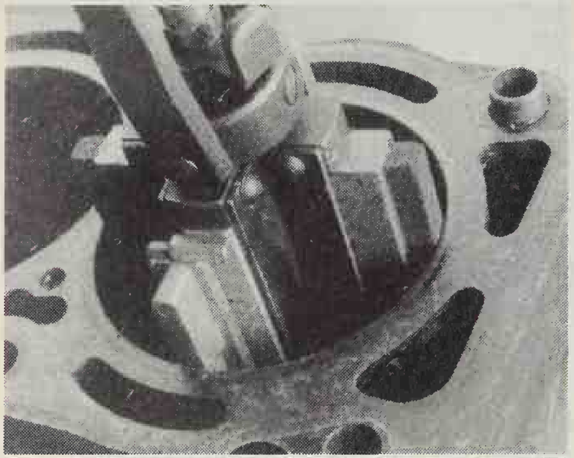

Piston Ring (No.1 Compression)
Piston Ring (No.2 Compression)
Piston Ring (Expander)
Piston Ring (Side Rail)
◆ Snap Ring
Connecting Rod
Piston Pin
Connecting Rod Bearing
Connecting Rod Cap
◆ Rear Oil Seal
3RZ-FE
No.1 Balance Shaft
Thrust Spacer
Thrust Plate
Key
× 6
Rear Oil Seal Retainer
No.2 Balance Shaft
Thrust Plate
Timing Sprocket
Timing Gear
Crankshaft Thrust Washer (Upper)
Main Bearing (Upper)
Crankshaft
Crankshaft Thrust Washer (Lower)
Main Bearing (Lower)
Main Bearing Cap
◆ Non-reusable part
86823pkp

Fig. 326 Exploded view of the 2RZ-FE and 3RZ-FE engine block



tccs3916

Fig. 327 Use a ridge cutter to remove the ridge from the cylinder bore

the bottom. Use a wooden hammer handle to push on the bottom of the piston top.

⁑⁑WARNING

Use care not to scratch the crank journals or the cylinder walls.

6. Keep the piston and bearing cap together.

CLEANING AND INSPECTION

Pistons

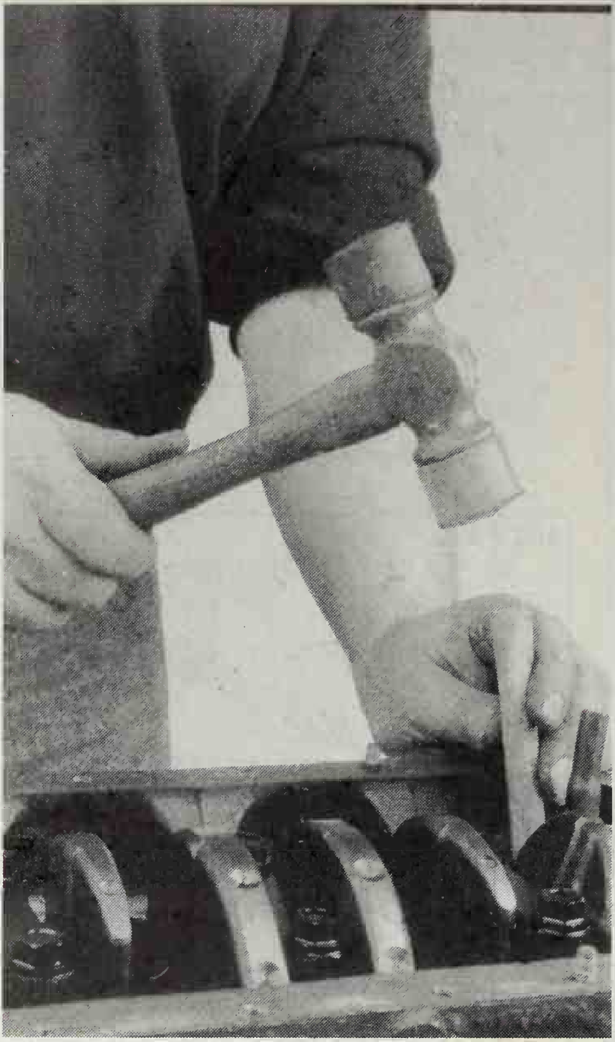
➧ See Figures 329, 330, 331 and 332

Clean the piston after removing the rings, by first scraping any carbon from the piston top. Do not scratch the piston in any way during cleaning. Use a broken piston ring or ring cleaning tool to clean out the ring grooves. Clean the entire piston with solvent and a stiff bristle brush (NOT a wire brush).

Once the piston is thoroughly cleaned, insert the side of a good piston ring (both No. 1 and No. 2 compression on each piston) into its respective groove. Using a feeler gauge, measure the clearance between the ring and its groove. If clearance is greater than the maximum listed under Ring Side Clearance in the Piston and Ring chart, replace the ring(s) and if necessary, the piston.

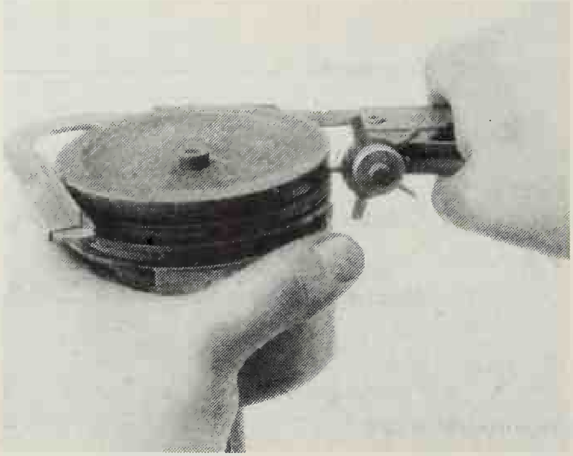
Place a rag over the crankshaft journals (the part the rods connect to). Wipe out each cylinder with a clean, solvent-soaked rag. Visually inspect the cylinder bores for roughness, scoring or scuffing; also check the bores by feel. Measure the cylinder bore diameter with an inside micrometer, or a telescope gauge and micrometer. Measure the bore at points parallel and perpendicular to the engine centerline at the top (below the ridge) and bottom of the bore. Subtract the bottom measurements from the top to determine cylinder taper.

Measure the piston diameter with a micrometer; since this particular micrometer may not be part of your tool kit you may wish to have the pistons measured at a machine shop. Take the measurements at right angles to the wrist pin center line, about an inch down the piston skirt from the top. Compare this



tccs3804

Fig. 328 Carefully tap the piston out of the bore using a wooden dowel



tccs3208

Fig. 329 Clean the piston grooves using a ring groove cleaner

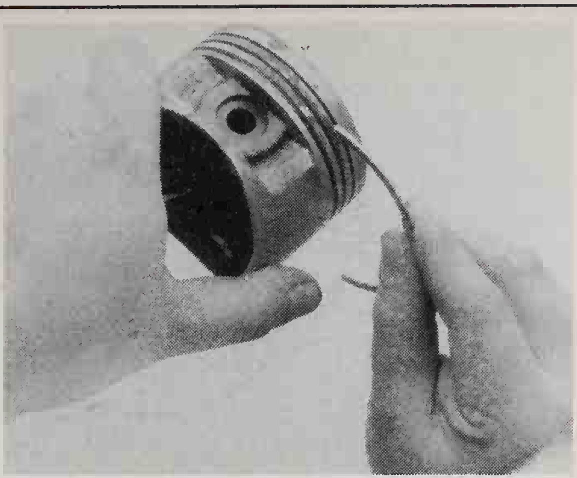


Fig. 330 You can use a piece of an old ring to clean the piston grooves, BUT be careful the ring is sharp

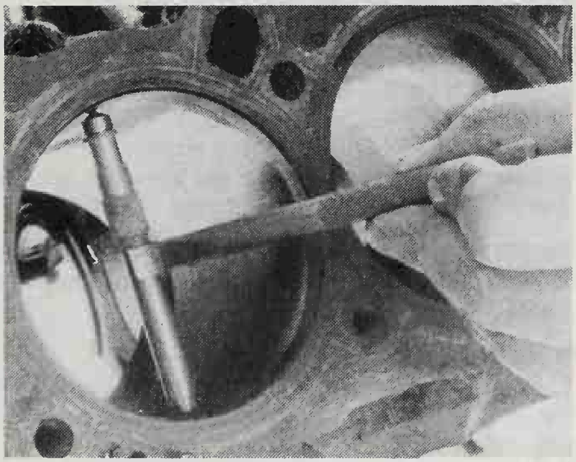


Fig. 331 A telescoping gauge may be used to measure the cylinder bore diameter

measurement to the bore diameter of each cylinder. The difference is the piston clearance. If the clearance is greater than that specified in the Piston and Ring Specifications chart, have the cylinders honed or rebored and replace the pistons with an oversize set.

Connecting Rods

Wash the connecting rods in cleaning solvent and dry them with compressed air. Check for twisted or bent rods and inspect for nicks or cracks. Replace the connecting rods that are damaged.

RIDGE REMOVAL AND HONING

1. Before the piston is removed from the cylinder, check for a ridge at the top of the cylinder bore. This ridge occurs because the piston ring does not travel all the way to the top of the bore, thereby leaving an unused portion of cylinder bore.

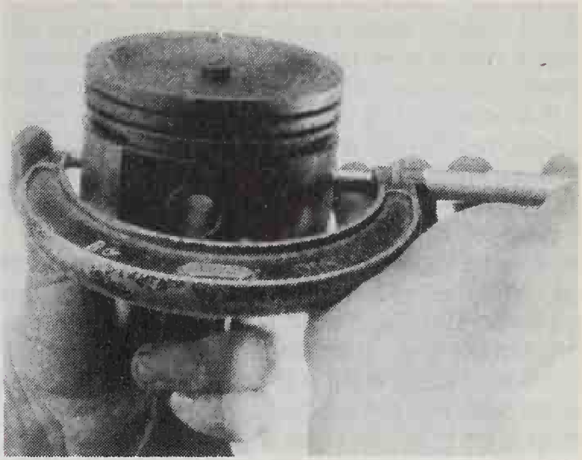


Fig. 332 Measure the piston's outer diameter using a micrometer

2. Clean away any carbon buildup at the top of the cylinder with sand paper, in order to see the extent of the ridge more clearly. If the ridge is slight, it will be safe to remove the pistons without damaging the rings or piston ring lands. If the ridge is severe, and easily catches your fingernail, it will have to be removed using a ridge reamer.
3. Install the ridge removal tool in the top of the cylinder bore. Carefully follow the manufacturers instructions for operation. Only remove the amount of material necessary to remove the ridge.

****WARNING**

Be very careful if you are unfamiliar with operating a ridge reamer. It is very easy to remove more cylinder bore material than you want, possibly requiring a cylinder overbore and piston replacement that may not have been necessary.

4. After the piston and connecting rod assembly have been removed, check the clearances as explained in the piston and connecting rod cleaning and inspection procedure, to determine whether boring and honing or just light honing are required. If boring is necessary, consult an automotive machine shop. If light honing is all that is necessary, proceed to the next step.

Honing is best done with the crankshaft removed, to prevent damage to the crankshaft and to make post-honing cleaning easier, as the honing process will scatter metal particles. However, if you do not want to remove the crankshaft, position the connecting rod journal for the cylinder being honed as far away from the bottom of the cylinder bore as possible, and wrap a shop cloth around the journal.

Honing can be done either with a flexible glaze breaker type hone or with a rigid hone that has honing stones and guide shoes. The flexible hone removes the least amount of metal, and is especially recommended if your piston-to-cylinder bore clearance is on the loose side. The flexible hone is useful to provide a finish on which the new piston rings will seat. A rigid hone will remove more material than the flexible hone and requires more operator skill.

5. Regardless of which type of hone you use, carefully follow the manufacturers instructions for operation.

6. The hone should be moved up and down the bore at sufficient speed to obtain a uniform finish. A rigid hone will provide a definite cross-hatch finish; operate the rigid hone at a speed to obtain a 45-65° included angle in the cross-hatch. The finish marks should be clean but not sharp, free from embedded particles and torn or folded metal.

7. Periodically during the honing procedure, thoroughly clean the cylinder bore and check the piston-to-bore clearance with the piston for that cylinder.

8. After honing is completed, thoroughly wash the cylinder bores and the rest of the engine with hot water and detergent. Scrub the bores well with a stiff bristle brush and rinse thoroughly with hot water. Thorough cleaning is essential, for if any abrasive material is left in the cylinder bore, it will rapidly wear the new rings and the cylinder bore. If any abrasive material is left in the rest of the engine, it will be picked up by the oil and carried throughout the engine, damaging bearings and other parts.

9. After the bores are cleaned, wipe them down with a clean cloth coated with light engine oil, to keep them from rusting.

PISTON PIN REPLACEMENT

➧ See Figures 333, 334, 335, 336, 337, 338 and 339

Wrist pin and/or connecting rod (small-end) bushing wear can be checked by rocking the piston at right angles to the wrist pin by hand. If more than very slight movement is felt, the pin and/or rod bushing must be replaced.

Except for the 3VZ-E engine, the pistons for the engines covered here must be heated in hot water to expand them before the wrist pins can be removed and installed. The four cylinder pistons must be heated to a specific temperature range. This job can be performed at a machine shop if the idea of boiling pistons in the kitchen doesn't appeal to you. If you decide to do it, however, remember that each piston, pin and connecting rod assembly is a matched set and must be kept together until reassembly.

On the 3VZ-E, the piston pins can be removed or installed with a press, but special precautions must be observed. The tip of the press must be the diameter of the pin so that force is applied evenly. The piston must be supported on a broad surface with an opening below the pin hole. Force must be exerted precisely straight on to the pin; any cocking of the piston may result in cracking the piston.

Although this process can be accomplished if the correct tools are at hand, it is still recommended to have the pins pressed by either a dealer or machine shop; the slight cost outweighs the risk (and cost) of replacing an otherwise good piston.

✻✻CAUTION

The components will be in water very close to the boiling point. Wear heavy waterproof gloves or have plenty of padding material available to protect your hands from burns or scalding.

1. Using a small flat-bladded tool, pry out the 2 snaprings.

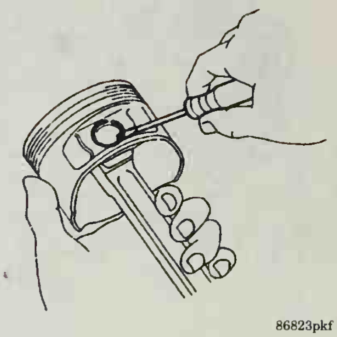


Fig. 333 Using a small flat-bladded tool, pry out the 2 snaprings

2. On the 3VZ-E engines, use a press and SST 09221-25024 and 09221-00181 or equivalent to press the pin from the piston.

3. Excluding the 3VZ-E, gradually heat the piston to:
   140°F (60°C) — 22R, 22R-E and 5VZ-FE
   176-194°F (80-90°C) — all other engines

4. Using a plastic faced hammer and brass bar, lightly tap the pin out and remove the connecting rod.

➡The piston and pin are a matched set. Arrange the pistons, pins, rings, bearings and connecting rods in the correct order.

To install:

5. On the 3VZ-E engine, coat the piston pin and pin holes with engine oil. Align the front marks of the piston and connecting rod. (A1. B6, 1B, 8A, C3 or etc.) Using the SST or equivalent from removal, press in the piston pin.

6. Excluding the 3VZ-E, install a new snapring on the one side of the piston pin hole. Gradually heat the piston to the correct temperature.

7. Coat the pin with engine oil.

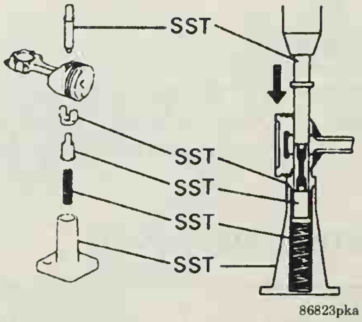


Fig. 334 On the 3VZ-E engine, the pin can be removed with a press

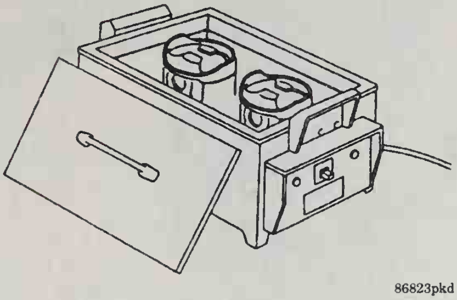


Fig. 335 On other engines, the piston must first be heated in water . . .

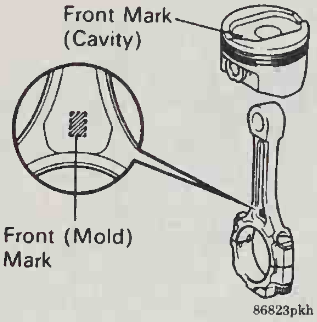


Fig. 338 Align the front marks of the piston and connecting rod

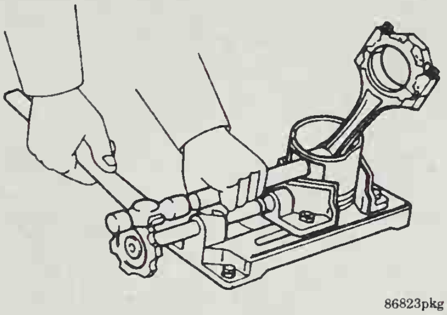


Fig. 336 . . . then the pin can be tapped out of the piston

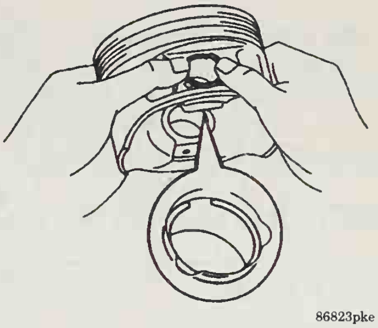


Fig. 339 Be sure that the end gap of the snapring is not aligned with the pin hole portion of the piston

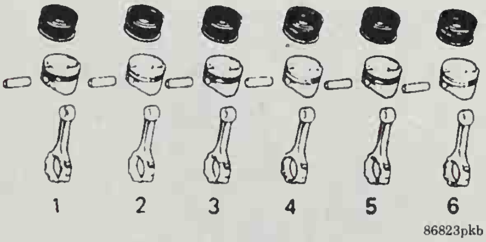


Fig. 337 Arrange the pistons, pins, rings, bearings and rods as sets

8. Align the front marks of the piston and connecting rod, then push in the pin with your thumb.
9. Install a new snapring on the other side of the hole.

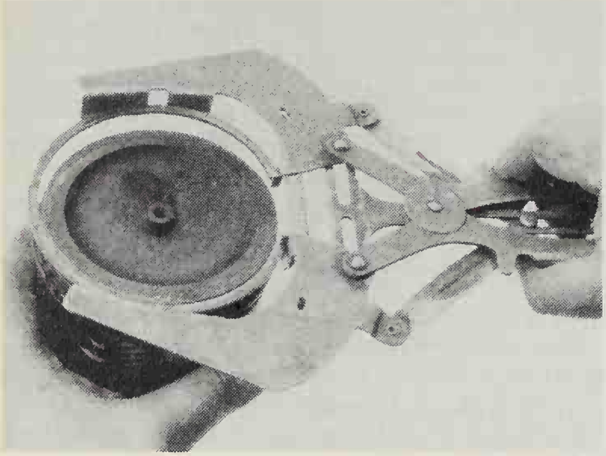
PISTON RING REPLACEMENT

➧ See Figures 340, 341, 342 and 343

➡The cylinder walls must be de-glazed (honed) when the piston rings are replaced. De-glazing insures proper ring seating and oil retention.

Using a piston ring expander, remove the rings one by one. Always remove and replace the rings of each piston before going on to the next. This helps avoid mixing up the rings. When the rings have been removed from each piston, perform the end gap procedure. The rings are marked on one side, the mark denoting the up side for installation.

To check ring end-gap, insert a compression ring into the cylinder. Lightly oil the cylinder bore and push the ring down



tccs3211

Fig. 340 Use a ring expander tool to remove the piston rings

into the cylinder with a piston, to the bottom of its travel. Measure the ring end-gap with a feeler gauge. If the gap is not within specification, replace the ring; DO NOT file the ring ends.

Install the rings using the ring expander, starting with the top compression ring and working down. Make sure the marks (T or N) are facing up on each ring. Position the rings so that the ring end gaps are staggered. Never align the end gaps nor with ANY gap facing the front of the cylinder.

ROD INSPECTION & BEARING REPLACEMENT

➧ See Figures 344 and 345

Connecting rod side clearance and crankshaft bearing inspection/replacement should be performed while the rods are still installed in the engine. Determine the clearance between the connecting rod sides and the crankshaft using a feeler gauge. If clearance is below the minimum, check with a machinist about machining the rod to provide adequate clearance or replace the rod. If clearance is excessive, substitute an

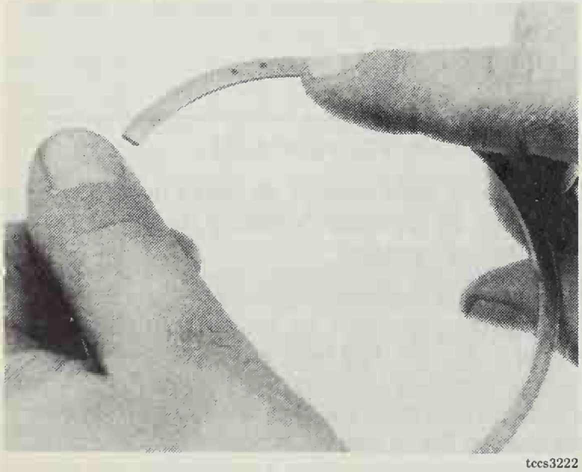


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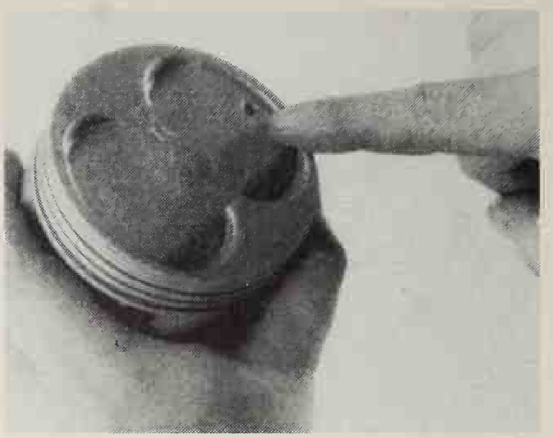
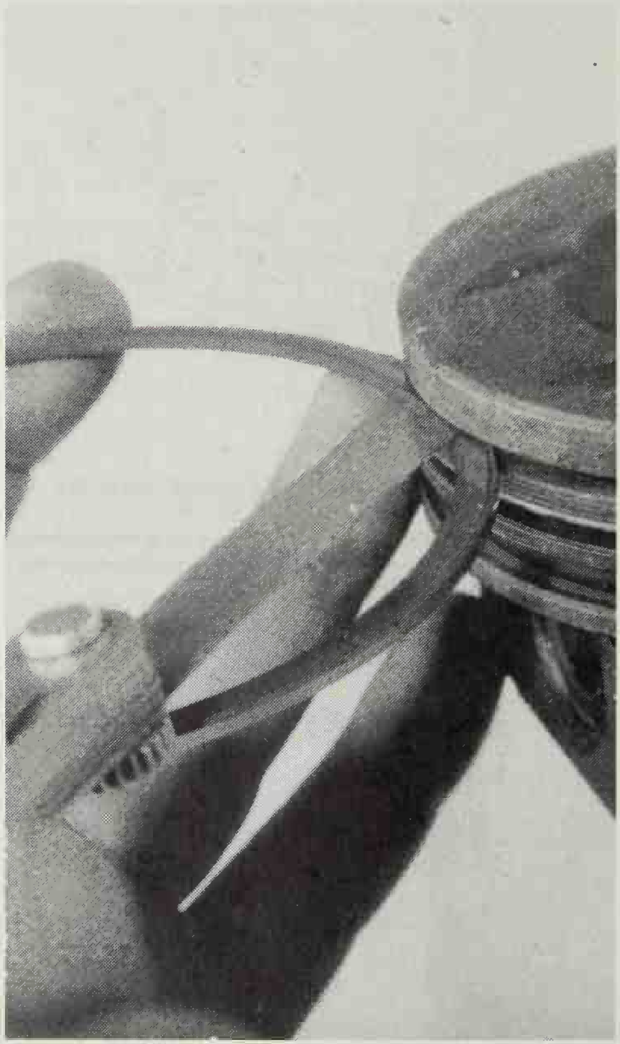
Fig. 341 Most rings are marked to show which side should face upward



tccs3814

Fig. 342 Most pistons are marked to indicate positioning in the engine



tccs3923

Fig. 343 Checking the ring-to-ring groove clearance

unworn rod and recheck; if clearance is still outside specifications, the crankshaft must be welded and reground, or replaced.

To check connecting rod bearing clearances, remove the rod bearing caps one at a time. Using a clean, dry shop rag, thoroughly clean all oil from the crank journal and bearing insert in the cap.

➡The Plastigage® gauging material is soluble in oil; any oil on the journal or bearing could result in an incorrect reading.

Place a strip of Plastigage® along the full length of the bearing insert (along the crank journal if the engine is out of the truck and inverted). Reinstall the cap and tighten to specifications listed in the Torque Specifications chart.

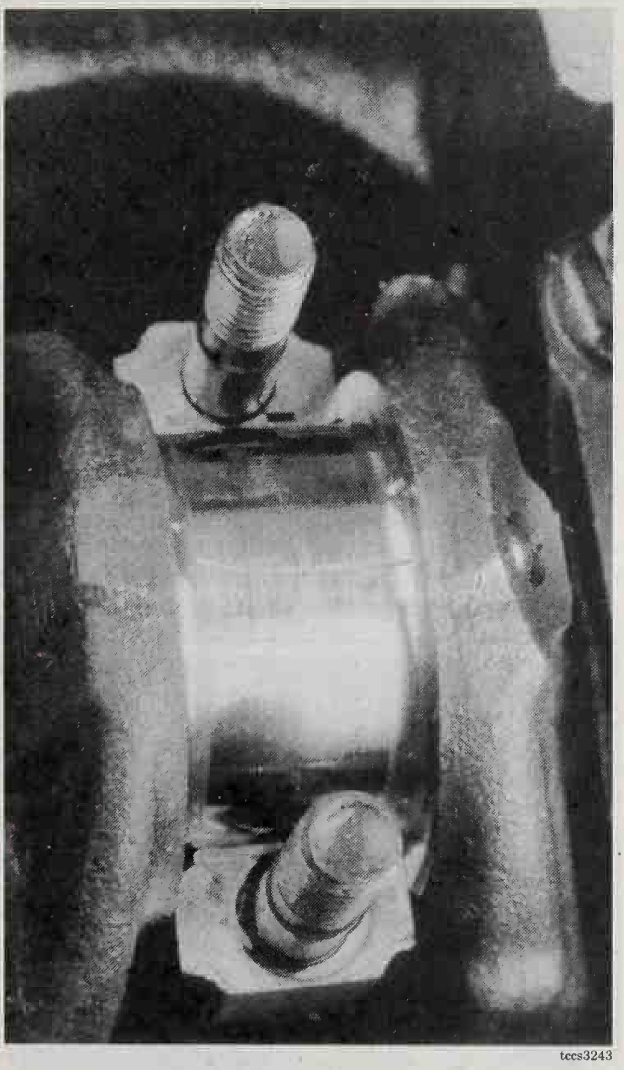
Remove the rod cap and determine the bearing clearance by comparing the width of the now flattened Plastigage® to the scale on the Plastigage® envelope. Journal taper is determined by comparing the width of the Plastigage® strip near its ends. Rotate the crankshaft 90° and retest, to determine journal eccentricity.

➡Do not rotate the crankshaft with the Plastigage® installed.

If the bearing insert and crank journal appear intact and are within tolerances, no further service is required and the bearing caps can be reinstalled (remove Plastigage® before installation). If clearances are not within tolerances, the bearing inserts in both the connecting rod and rod cap must be replaced with undersize inserts, and/or the crankshaft must be reground.

To install the bearing insert halves, press them into the bearing caps and connecting rods. Make sure the tab in each insert fits into the notch in each rod and cap. Lube the face of each insert with engine oil prior to installing each rod into the engine.

The connecting rods can be further inspected when they are removed from the engine and separated from their pistons. Rod alignment (straightness and squareness) must be checked by a machinist, as the rod must be set in a special fixture. Many machine shops also perform a crack checking service, a process that shows up any tiny cracks in the metal.



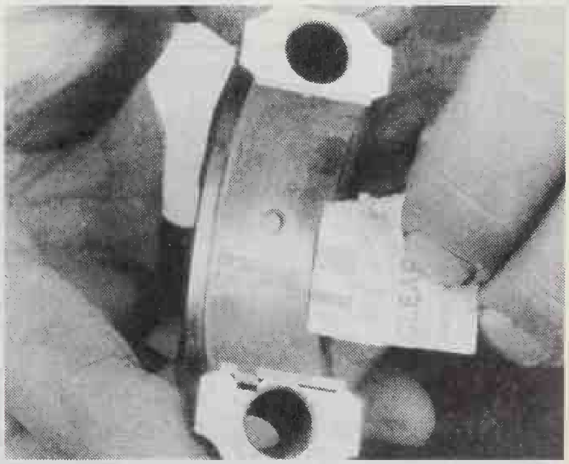
tccs3243

Fig. 344 Apply a strip of gauging material to the bearing journal, then install and tighten the cap

INSTALLATION

➧ See Figures 346 and 347

1. Apply a light coating of engine oil to the pistons, rings, and outer ends of the wrist pins (piston pins).
2. Examine the piston to insure that it has been assembled with its parts positioned correctly. Be sure that the ring gaps are not pointed toward the thrust face of the piston and that the gaps are not aligned.
3. Place pieces of rubber hose over the connecting rod bolts, to keep the threads from damaging the crank journal and cylinder bore. Install the pistons, using a ring compressor,



tccs3912

Fig. 345 After the cap is removed again, use the scale supplied with the gauge material to check clearances

into the cylinder bore. Be sure that the appropriate marks on the piston are facing the front of the cylinder.

➡It is important that the pistons, rods, bearing, etc., be returned to the same cylinder bore from which they were removed.

4. Remove the protective rubber hoses. Make certain the connecting rod and cap have the bearings correctly installed. Fit the cap to the rod bolts; tighten them to the torque figures given in the Torque Specifications chart.

➡Be sure that the mating marks on the connecting rods and rod bearing caps are aligned.

5. The rest of the removal procedure is performed in the reverse order of installation.

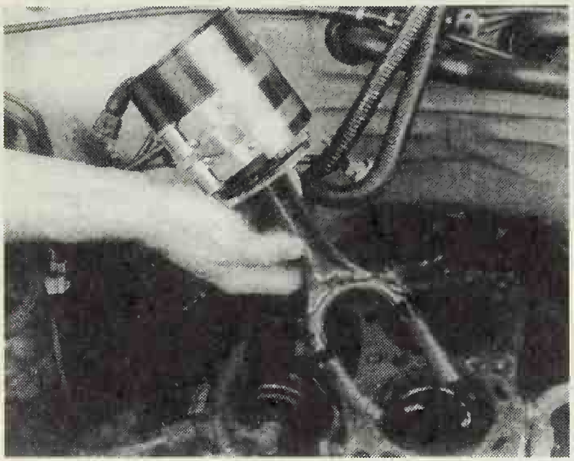

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Fig. 346 With rubber hoses on the rod bolts, insert the piston into the cylinder

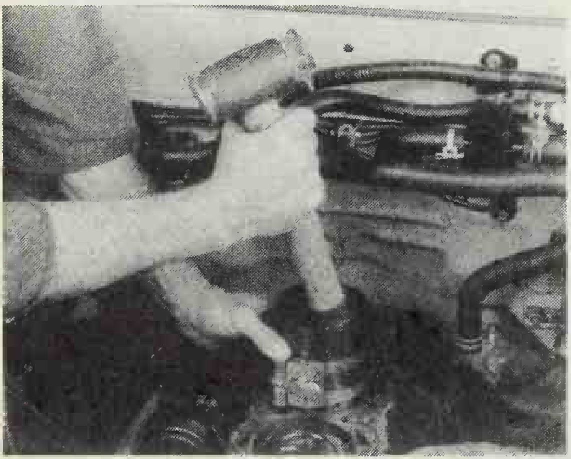
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Fig. 347 With a wooden dowel or a hammer shaft, gently insert the piston

Freeze Plugs

REMOVAL & INSTALLATION

See Figures 348 and 349

1. Raise and safely support the vehicle, as required.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

2. Drain the cooling system. If the freeze plug is located in the cylinder block, it will be necessary to remove the drain plug from the side of the block to make sure all coolant is drained.
3. Drill a ½ in. (13mm) hole in the center of the plug. Remove the plug with a slide hammer or pry it out with a prybar.

➡Be careful to stop drilling as soon as the bit breaks through the plug to prevent damaging the engine.

4. Clean all dirt and corrosion from the freeze plug bore. Check the freeze plug bore for damage that would interfere with sealing. If the bore is damaged, the bore will have to be machined for an oversize plug.

To install:

5. Coat the plug bore and the freeze plug sealing surface with water proof sealer.
6. Install cup-type freeze plugs with the flanged edge outward. The plug must be driven in with a tool that does not contact the flange of the plug. If an improper tool is used, the plug sealing edge will be damaged and leakage will result.

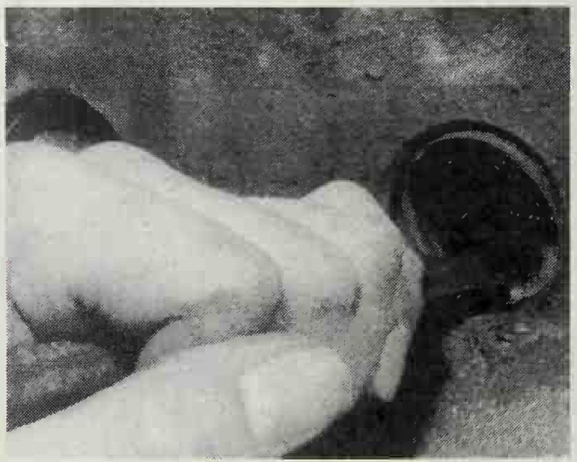

TCCS3905

Fig. 348 Using a punch and hammer, the freeze plug can be loosened in the block

Fig. 349 Once the freeze plug has been loosened, it can be removed from the block

7. Expansion-type freeze plugs are installed with the flanged edge inward. The plug must be driven in with a tool that does not contact the crowned portion of the plug. If an improper tool is used, the plug and/or plug bore will be damaged.
8. Replace any drain plugs that were removed and lower the vehicle.
9. Fill the cooling system, start the engine and check for leaks.

Block Heaters

REMOVAL & INSTALLATION

Factory block heaters are not installed on Toyota trucks any more. If an aftermarket one has been installed, the following procedure should be useful. There are two basic types, one for oil and one for coolant. The oil heater usually just slips into the dipstick tube or replaces the oil drain plug. The following procedure is for the coolant type.

1. Remove the negative battery cable.
2. Drain the cooling system.

✲✲CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Remove the block heater in the same way as the freeze plugs. Some heater units have a bolt that must be loosened or a V-clamp that must be unsecured to remove the heating element.
4. Disconnect the heater wire and remove the heater element.
5. Coat the new heater with sealant reinstall into the engine.
6. Fill the engine with a coolant and water mixture.
7. Start the engine, check for leaks and top off the coolant.

Rear Main Oil Seal

REMOVAL & INSTALLATION

Seal Retainer On Engine

➧ See Figures 350 and 351

1. Remove the transmission.
2. Remove the clutch cover assembly and flywheel (manual trans.) or the flexplate (auto. trans.).
3. Use a small, sharp knife to cut off the lip of the oil seal. Take great care not to score any metal with the knife.
4. Use a small prybar to pry the old seal from the retaining plate. Be careful not to damage the plate. Protect the tip of the tool with tape and pad the fulcrum point with cloth.
5. Inspect the crankshaft and seal lip contact surfaces for any sign of damage.

To install:

6. Apply a light coat of multi-purpose grease to the lip of a new oil seal. Loosely fit the seal into place by hand, making sure it is not crooked.
7. Use a seal driver such as (SST 09223-15030 and 09950-70010) of the correct size to install the seal. Tap it into place until the surface of the seal is flush with the edge of the housing.

➡Use the correct tools. Homemade substitutes may install the seal crooked, resulting in oil leaks and premature seal failure.

Seal Retainer Removed

➧ See Figures 352 and 353

1. Support the retainer on two thin pieces of wood.

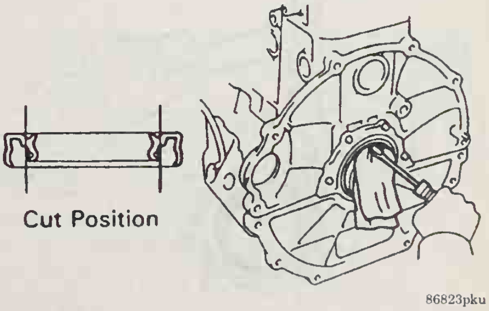


Fig. 350 Cut off the oil seal lip, then pry the seal out of the retaining plate

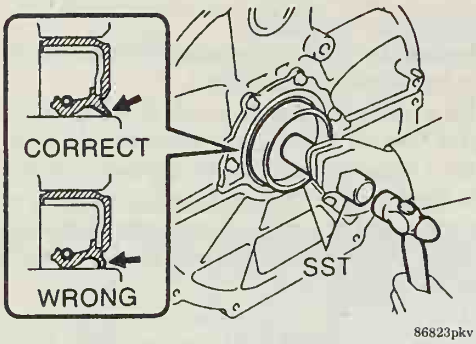


Fig. 351 Tap the new seal into place

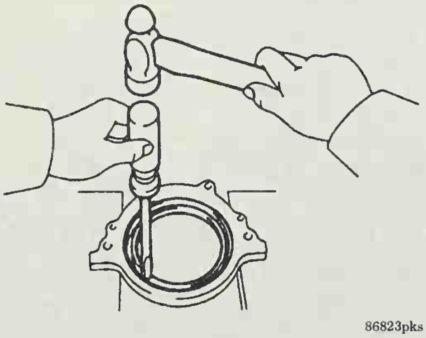


Fig. 352 Carefully tap the old seal from the retainer

2. Use a small prybar to pry the old seal from the retaining plate. Be careful not to damage the plate. Protect the tip of the tool with tape and pad the fulcrum point with cloth.

To install:

3. Apply a light coat of multi-purpose grease to the lip of a new oil seal. Loosely fit the seal into place by hand, making sure it is not crooked.

4. Use a seal driver such as (SST 09223-15030 and 09950-70010) of the correct size to install the seal. Tap it into place until the surface of the seal is flush with the edge of the housing.

Crankshaft and Main Bearings

REMOVAL & INSTALLATION

See Figures 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365 and 366

➡Before removing the crankshaft, check main bearing clearances as described in Main Bearing Clearance Check. This check should always be performed before and after any repairs to the crank or bearings.

1. Remove the piston and connecting rod assemblies.

2. Check crankshaft thrust clearance (end play) before removing the crank from the block. Using a small prybar, gently force the crankshaft the extent of its travel forward, and measure thrust clearance at the center main bearing (No. 4 bearing on 6-cylinder engines, No. 3 on 4-cylinder engines) with a feeler gauge. Pry the crankshaft the extent of its rearward travel, and measure the other side of the bearing. If clearance is greater than that specified, the thrust washers must be replaced.

3. Using a punch, mark the corresponding main bearing caps and saddles according to position: one punch (dot) on the front main cap and saddle, two on the second, three on the third, etc. This ensures correct reassembly.

4. Remove the main bearing caps after they have been marked.

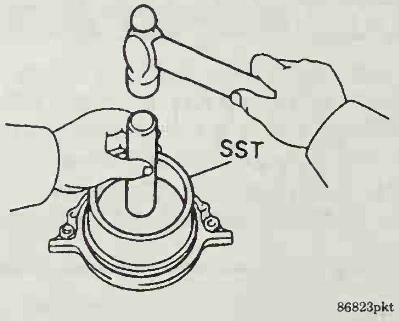


Fig. 353 Use a proper sized driver to seat the seal

5. Remove the crankshaft from the block. The crankshaft, even from a small engine is heavy. Be prepared to control the weight, particularly if working under the engine.

To install:

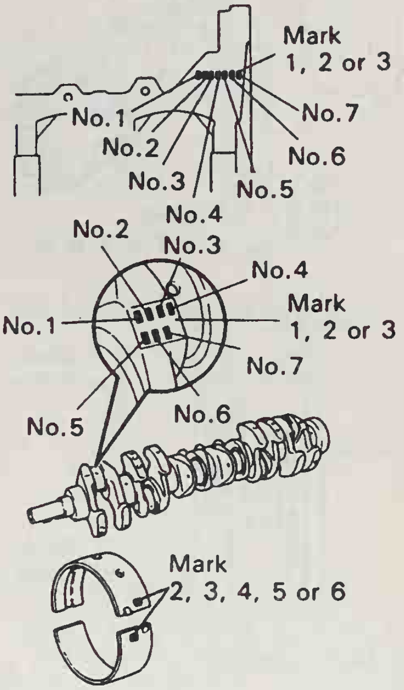
6. Replace the front and rear crankshaft oil seals.
7. Place the crankshaft on the cylinder block.
8. Install the main bearing caps and the lower thrust washers. Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
9. Install and tighten the main bearing caps in several passes. If any one cap does not meet torque specification, replace the main bearing cap bolt.
10. Mark the front of the main bearing cap bolt with paint, then retighten the cap bolts by 90° in the order needed.

➡If new bearings are being installed, be sure to check the clearances first.

11. Check the mark making sure it is now facing at a 90° angle to the front.
12. Check that the crankshaft turns smoothly, then check the thrust clearance.

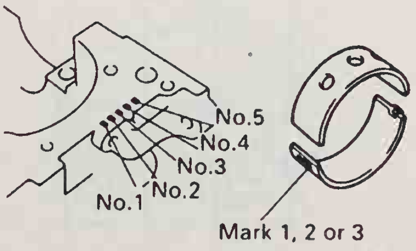
CLEANING AND INSPECTION

Crankshaft inspection and servicing should be handled exclusively by a reputable machinist, as most of the necessary procedures require a dial indicator, fixing jig, a large micrometer, and machine tools such as a crankshaft grinder. While at the machine shop, the crankshaft should be thoroughly cleaned (especially the oil passages) and crack-checked. Additionally, have it checked for: main journal diameter, crank pin (connecting rod journal) diameter, taper, out-of-round, and run-out. Wear, beyond specification limits, in any of these areas means the crankshaft must be reground or replaced.



86823pli

Fig. 355 The 1FZ-FE engine has markings as shown



86823plf

Fig. 354 The bearing and block markings on the 2RZ-FE and 3RZ-FE engines

	Number marked								
Cylinder block	1			2			3		
Crankshaft	1	2	3	1	2	3	1	2	3
Use bearing	2	3	4	3	4	5	4	5	6

EXAMPLE: Cylinder block "2" + Crankshaft "1"
= Total number 3 (Use bearing "3")

86823plk

Fig. 356 Bearing selection chart for the 1FZ-FE engine

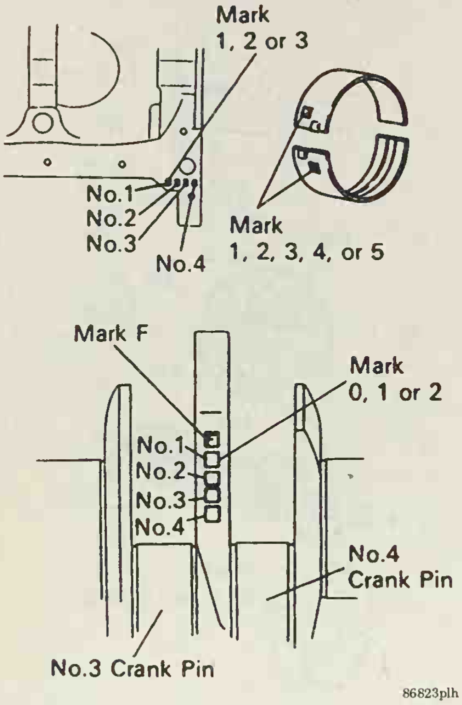

Mark
1, 2 or 3
No.1
No.2
No.3
No.4
Mark
1, 2, 3, 4, or 5
Mark F
Mark
0, 1 or 2
No.1
No.2
No.3
No.4
No.4
Crank Pin
No.3 Crank Pin
86823plh

Fig. 357 Bearing and block markings for the 5VZ-FE engine

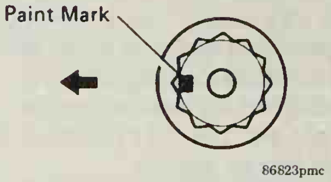

Paint Mark
86823pmc

Fig. 359 Mark with paint the front of the main bearing cap bolt

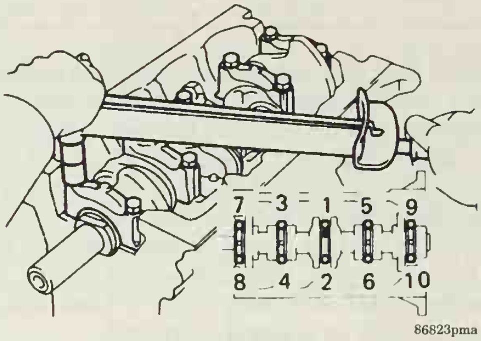

7
3
1
5
9
8
4
2
6
10
86823pma

Fig. 360 Main bearing tightening sequence — 22R and 22R-E engines

	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "1"
= Total number 3 (Use bearing "3")

86823plg

Fig. 358 Bearing selection chart for the 5VZ-FE engine

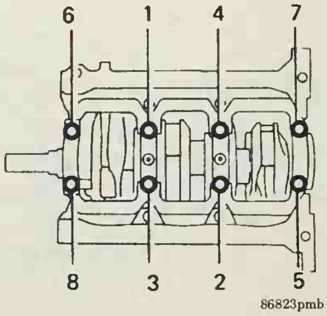
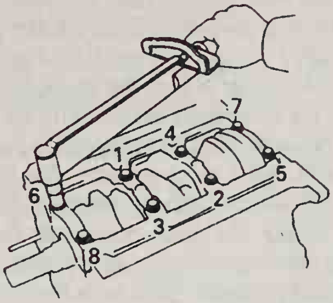
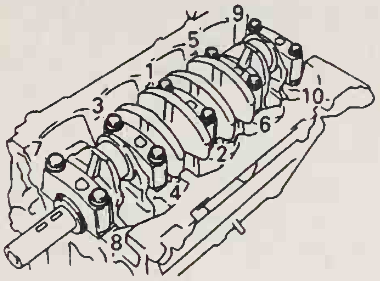

6
1
4
7
8
3
2
5
86823pmb

Fig. 361 Main bearing tightening sequence — 3VZ-E engine



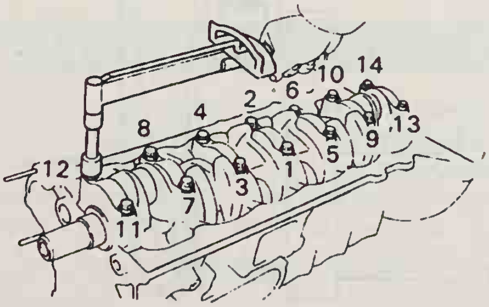
86823pme

Fig. 362 Main bearing tightening sequence — 5VZ-FE engine



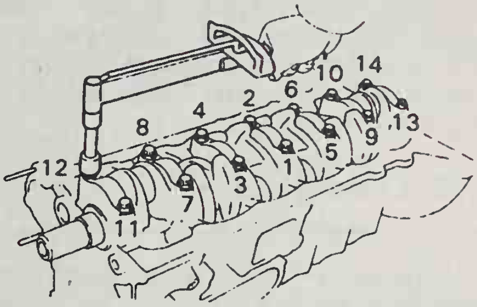
86823pmf

Fig. 363 Main bearing tightening sequence — 2VZ-FE and 3VZ-FE engines



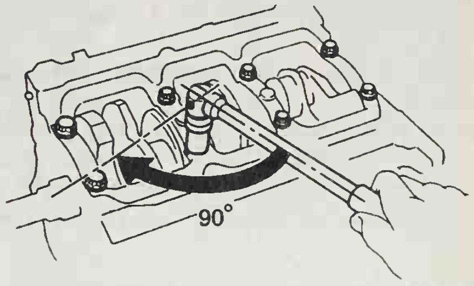
86823pmg

Fig. 364 Main bearing tightening sequence — 3F-E engine



86823pmh

Fig. 365 Main bearing tightening sequence — 1FZ-FE engine



86823pmd

Fig. 366 Tighten the bolts an additional 90°

MAIN BEARING CLEARANCE CHECK

Checking main bearing clearances is done in the same manner as checking connecting rod clearances.

1. With the crankshaft installed, remove the main bearing cap to be checked. Clean all oil from the bearing insert in the cap and from the crankshaft journal, as the Plastigage® material is oil-soluble.
2. Lay a strip of Plastigage® along the full width of the bearing cap (or along the width of the crank journal if the engine is out of the truck and inverted).
3. Install the bearing cap and tighten to specification.

➡Do not rotate the crankshaft with the Plastigage® installed.

4. Remove the bearing cap and determine bearing clearance by comparing the width of the now-flattened Plastigage® with the scale on the Plastigage® envelope. Journal taper is determined by comparing the width of the Plastigage® strip

near its ends. Rotate the crankshaft 90° and retest, to determine journal eccentricity.

5. Repeat for the remaining bearings. If the bearing journal and insert appear in good shape (with no unusual wear visible) and are within tolerances, no further main bearing service is required. If unusual wear is evident and/or the clearances are outside specifications, the bearings must be replaced and the cause of their wear found.

BEARING REPLACEMENT

Main bearings can be replaced with the crankshaft in the engine (with the engine still in the truck) or with the engine on a work stand or bench. Both procedures are covered here. The main bearings must be replaced if the crankshaft has been reground; the replacement bearing being available in various undersize increments from most auto parts jobbers or your Toyota dealer.

Engine Removed

1. Remove the crankshaft from the engine block.
2. Remove the main bearing inserts from the bearing caps and from the main bearing saddles. Remove the thrust washers from the No. 3 (4 cylinder) or No. 4 (6 cylinder) crank journal.
3. Thoroughly clean the saddles, bearing caps, and crankshaft.
4. Make sure the crankshaft has been fully checked and is ready for reassembly. Place the upper main bearings in the block saddles so that the oil grooves and/or oil holes are correctly aligned with their corresponding grooves or holes in the saddles.

➡On the 3F-E, the outer diameter varies with each bearing location; additionally, all the main bearings have oil holes except Nos. 1 and 4 on the lower side.

5. Install the thrust washers on the center main bearing, with the oil grooves facing out.
6. Lubricate the faces of all bearings with clean engine oil, and place the crankshaft in the block. On 3F-E, apply sealant to the block in the location of the front and rear main bearing cap contact points.
7. Install the main bearing caps in numbered order with the arrows or any other orientation marks facing forward. Tighten the cap bolts in the correct sequence in two or three passes. Rotate the crankshaft after each pass to ensure even tightness. On 3VZ-E engines, once the caps are installed, bring the bolts to 45 ft. lbs. (61 Nm) in several passes and in the correct order. If any bolt will not tighten to this specification, the bolt must be replaced. Mark the front face of each bolt with paint; turn each bolt an additional 90° so that the paint marks now face the side of the engine. Check that the crankshaft turns smoothly.
8. Check the crankshaft thrust clearance (end play). If clearance is outside specifications (too sloppy), install a new set of oversize thrust washers and check clearance again.

Engine Installed

➧ See Figures 367 and 368

1. Remove the main bearing caps and keep them in order.
2. Make a bearing roll-out pin from a cotter pin.
3. Use the cotter pin tool to carefully roll out the old bearing inserts from the upper side of the crankshaft journal, noting the positions of the oil grooves and/or oil holes so the new inserts can be correctly installed. This rolling-out of the bearing takes a light touch and a bit of patience. The bearing must be rotated a full 180° before it can be removed. Take great care not to mark or scratch the crank journal with the cotter pin.
4. Roll each new insert into its saddle after lightly oiling the crankshaft-side face of each. Make sure the notches and/or oil holes are correctly positioned.
5. Replace the bearing inserts in the caps with new inserts. Oil the face of each, and install the caps in numbered order with the arrows or other orientation marks facing forward.
6. Install the bearing cap following the correct procedure.

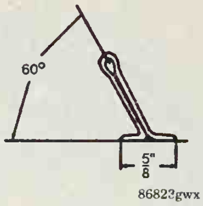


Fig. 367 A bearing roll-out pin may be made from a cotter pin

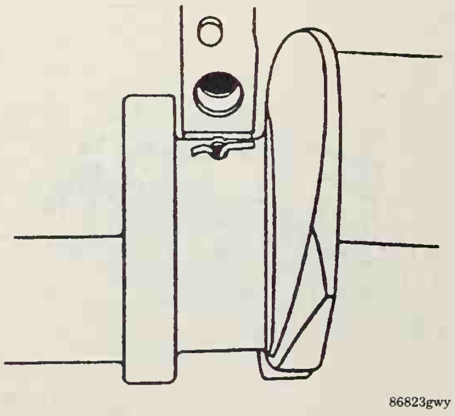


Fig. 368 Roll-out pin shown installed for removing the upper half of the main bearing

Flywheel and Ring Gear

REMOVAL & INSTALLATION

See Figures 369 and 370

1. If the engine is installed in the vehicle, remove the transmission.
2. Remove the clutch assembly, if equipped with manual transmission.
3. Make matchmarks on the flywheel and crankshaft end. Loosen the bolts holding the flywheel or driveplate a little at a time and in a crisscross pattern. Remove the flywheel; it is heavy. Protect the flywheel and ring-gear from damage or impact. Keep your feet clear of accidental dropping.

To install:

4. Thoroughly clean the flywheel bolts. Coat the first 3 or 4 threads of each bolt with sealant. Install the flywheel, aligning the previously made marks. Install the bolts finger-tight.
5. Tighten the bolts in a crisscross pattern and in several passes to the correct tightness:
   - 22R/22R-E manual trans — 80 ft. lbs. (108 Nm)
   - 3VZ-E and 2RZ-FE manual trans — 65 ft. lbs. (88 Nm)
   - 3RZ-FE manual trans — 1st pass; 19 ft. lbs. (26 Nm), 2nd pass turn 90°
   - 22R, 22R-E, 3VZ-E and 5VZ-FE auto. trans. — 61 ft. lbs. (83 Nm)
   - 3F-E auto trans. — 64 ft. lbs. (87 Nm)
   - 2RZ-FE and 3RZ-FE auto trans — 54 ft. lbs. (74 Nm)
   - 1FZ-FE auto trans. — 74 ft. lbs. (100 Nm)
6. Reinstall the transmission.

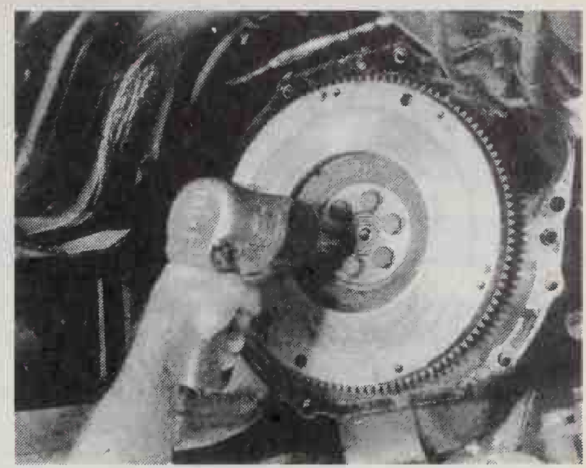

86823pmj

Fig. 369 If a flywheel holding tool is not available, an air gun may be used to loosen the bolts

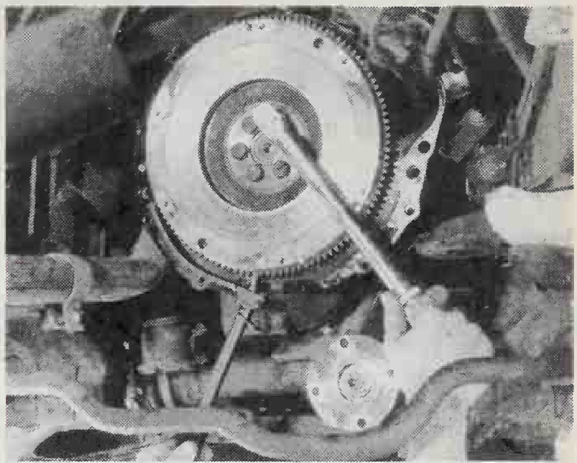

86823pmi

Fig. 370 Always tighten the bolts with a torque wrench. Note the flywheel holding tool

EXHAUST SYSTEM

General Information

➡Safety glasses should be worn at all times when working on or near the exhaust system. Older exhaust systems will almost always be covered with loose rust particles which will shower you when disturbed. These particles are more than a nuisance and could injure your eye.

Whenever working on the exhaust system always keep the following in mind:

- Check the complete exhaust system for open seams, holes loose connections, or other deterioration which could permit exhaust fumes to seep into the passenger compartment.
- The exhaust system is usually supported by free-hanging rubber mountings which permit some movement of the exhaust system, but does not permit transfer of noise and vibration into the passenger compartment. Do not replace the rubber mounts with solid ones.
- Before removing any component of the exhaust system, ALWAYS squirt a liquid rust dissolving agent onto the fasteners for ease of removal. A lot of knuckle skin will be saved by following this rule. It may even be wise to spray the fasteners and allow them to sit overnight.

⁂CAUTION

Allow the exhaust system to cool sufficiently before spraying a solvent exhaust fasteners. Some solvents are highly flammable and could ignite when sprayed on hot exhaust components.

- Annoying rattles and noise vibrations in the exhaust system are usually caused by misalignment of the parts. When aligning the system, leave all bolts and nuts loose until all parts are properly aligned, then tighten, working from front to rear.

- When installing exhaust system parts, make sure there is enough clearance between the hot exhaust parts and pipes and hoses that would be adversely affected by excessive heat. Also make sure there is adequate clearance from the floor pan to avoid possible overheating of the floor.

Safety Precautions

For a number of reasons, exhaust system work can be the most dangerous type of work you can do on your car. Always observe the following precautions:

- Support the car extra securely. Not only will you often be working directly under it, but you'll frequently be using a lot of force, such as heavy hammer blows, to dislodge rusted parts. This can cause a vehicle that's improperly supported to shift and possibly fall.
- Wear goggles. Exhaust system parts are always rusty. Metal chips can be dislodged, even when you're only turning rusted bolts. Attempting to pry pipes apart with a chisel makes the chips fly even more frequently.
- If you're using a cutting torch, keep it a great distance from either the fuel tank or lines. Stop what you're doing and feel the temperature of the fuel pipes on the tank frequently. Even slight heat can expand and/or vaporize fuel, resulting in accumulated vapor (or even a liquid leak) near your torch.
- Watch where your hammer blows fall and make sure you hit squarely. You could easily tap a brake or fuel line when you hit an exhaust system part with a glancing blow. Inspect all lines and hoses in the area where you've been working.

⁂CAUTION

Be very careful when working on or near the catalytic converter. External temperatures can reach 1,500°F (816°C) and more, causing severe burns. Removal or installation should be performed only on a cold exhaust system.

A number of special exhaust system tools can be rented from auto supply houses or local stores that rent special equipment. A common one is a tail pipe expander, designed to enable you to join pipes of identical diameter.

The exhaust system of Toyota trucks consists of several pieces. At the front of a 4-cylinder vehicle, the first section of pipe connects the exhaust manifold to the catalytic converter. The V-6 3VZ-E uses a crossover or Y-pipe below the engine to connect the two exhaust manifold ports. The in-line 6-cylinder 3F-E uses a Y-pipe to connect the two outputs from the exhaust manifold. The catalytic converter is a sealed, non-serviceable unit which can be easily unbolted from the system and replaced if necessary.

The exhaust system is attached to the body by several hooks and flexible rubber hangers; these hangers absorb exhaust vibrations and isolate the system from the body of the car. A series of metal heat shields runs along the exhaust piping, protecting the underbody from excess heat.

When inspecting or replacing exhaust system parts, make sure there is adequate clearance from all points on the body to avoid possible overheating of the floorpan. Check the complete system for broken damaged, missing or poorly positioned parts. Rattles and vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all the nuts and bolts loose until everything is in its proper place, then tighten the hardware working from the front to the rear. Remember that what appears to be proper clearance during repair may change as the truck moves down the road. The motion of the engine, body and suspension must be considered when replacing parts.

REMOVAL & INSTALLATION

⁂CAUTION

Do NOT perform exhaust repairs with the engine or exhaust hot. Allow the system to cool completely before attempting any work. Exhaust systems are noted for sharp edges, flaking metal and rusted bolts. Gloves and eye protection are required. A healthy supply of penetrating oil and rags is highly recommended.

Catalytic Converter

EXCEPT 1FZ-FE LAND CRUISER

1. Raise and support the truck on jackstands.
2. Remove the heat shield(s).
3. Some models have rubber O-ring supports; that may be in the way of removal, detach them, ensuring there is another support for the converter once removed.
4. On some models you will need to remove the oxygen sensor. Unbolt the oxygen sensor and remove it. Protect the tip of the sensor from damage and do not place it on or near any petroleum based solvents. This includes putting it on a greasy rag.
5. Remove the bolts at the front and rear of the converter. On 3F-E, disconnect the converter pipe from the manifold first, then disconnect it at the Y-pipe.

➡Always support the pipe running to the manifold, either by the normal clamps/hangers or by using string, stiff wire, etc. If left loose, the pipe can develop enough leverage to crack the manifold.

6. Remove the converter and gaskets.

To install:

7. Check the rubber supports that hang the exhaust, they have a tendency to stretch and crack with age, replace if necessary.
8. Using new gaskets, attach the converter to the exhaust pipes. Tighten the bolts to 29 ft. lbs. (39 Nm) on the 5VZ-FE 35 ft. lbs. (48 Nm).

➡ALWAYS use a new gasket at each pipe joint whenever the joint is disassembled. Use new nuts and bolts to hold the joint properly. These two low-cost items will serve to prevent future leaks as the system ages.

9. On models with the oxygen sensor in the catalyst, tighten the nuts to 14 ft. lbs. (20 Nm). Don't forget to connect the wire harness.
10. On 3F-E, attach the pipe to the manifold (with a new gasket) and tighten the nuts to 46 ft. lbs. (62 Nm).

1FZ-FE LAND CRUISER

1. The 1FZ-FE Land Cruiser has a front and rear catalyst.
   a. Unbolt and remove the oxygen sensor.
   b. Loosen the front exhaust pipe at the manifold and the rear bolts to the No. 2 catalyst.
   c. Support the rear catalyst if it is not to be removed, then remove the mounting bolts for the front pipe and gaskets, then lower.

To install:

2. On the 1FZ-FE, attach the front catalyst to the manifold and rear catalyst.
   a. Keeping the system supported, hand tighten the mounting nuts.
   b. Attach the oxygen sensor to the pipe, tighten to 14 ft. lbs. (20 Nm).
   c. Tighten the rear catalyst mounting bolts to 29 ft. lbs. (39 Nm) and the front pipe-to-converter to 46 ft. lbs. (63 Nm).

Muffler and/or Tail Pipe

The muffler and tail pipe on trucks and 4Runner is one piece and should be replaced as a unit. On the Land Cruiser, the tailpipe can be unbolted from the muffler. Both mufflers include the lead-in pipe to the muffler. All Toyota exhaust components bolt together with gaskets at the joints; no welding is involved. To remove the muffler and/or tailpipe:

1. Elevate and firmly support the rear of the vehicle.
2. On some models you will need to remove the oxygen sensor. Unbolt the oxygen sensor and remove it. Protect the tip of the sensor from damage and do not place it on or near any petroleum based solvents. This includes putting it on a greasy rag.
3. Disconnect the nuts holding the muffler and/or tailpipe to the adjacent pipes.
4. Remove or disconnect the clamps and supports holding the pipe at either end. Leave the supports closest to the center in place until last.
5. Remove the last supports or hangers and lower the unit to the ground. At NO TIME should the muffler be allowed to hang partially supported; the leverage can break the next component in line.

➡If the muffler or tailpipe is being replaced due to rust or corrosion, adjacent pipes should be checked for the same condition. The pieces tend to age at about the same rate.

To install:

6. Check the rubber supports that hang the exhaust, they have a tendency to stretch and crack with age, replace if necessary.
7. Lift the new unit into place and loosely attach the hangers or supports to hold it in place. Allow some play to adjust the muffler.
8. Using new gaskets, connect each end to the adjoining pipe. Tighten the joint bolts and nuts to 29 ft. lbs. (39 Nm).

➡ALWAYS use a new gasket at each pipe joint whenever the joint is disassembled. Use new nuts and bolts to hold the joint properly. These two low-cost items will serve to prevent future leaks as the system ages.

9. Tighten the supports and hangers. Make certain the rubber hangers are securely attached to their mounts.

Complete System

➧ See Figures 371, 372, 373, 374, 375, 376 and 377

If the entire exhaust system is to be replaced, it is much easier to remove the system as a unit than remove each individual piece. Disconnect the first pipe at the manifold joint and work towards the rear removing brackets and hangers as you go. Separate the rear pipe at the catalytic converter. Remove any retaining brackets and O-rings from the center of exhaust system and back. Then slide the rear section of the exhaust system out from the back the truck. When removed from the vehicle, then you can detach the catalyst from the system, this is usually the one good part.

The new system can then be bolted up on the workbench and easily checked for proper tightness and gasket integrity. When installing the new assembly, suspend it from the flexible hangers first, then attach the fixed (solid) brackets. Check the clearance to the body and suspension and install the manifold joint bolts, tightening them correctly.

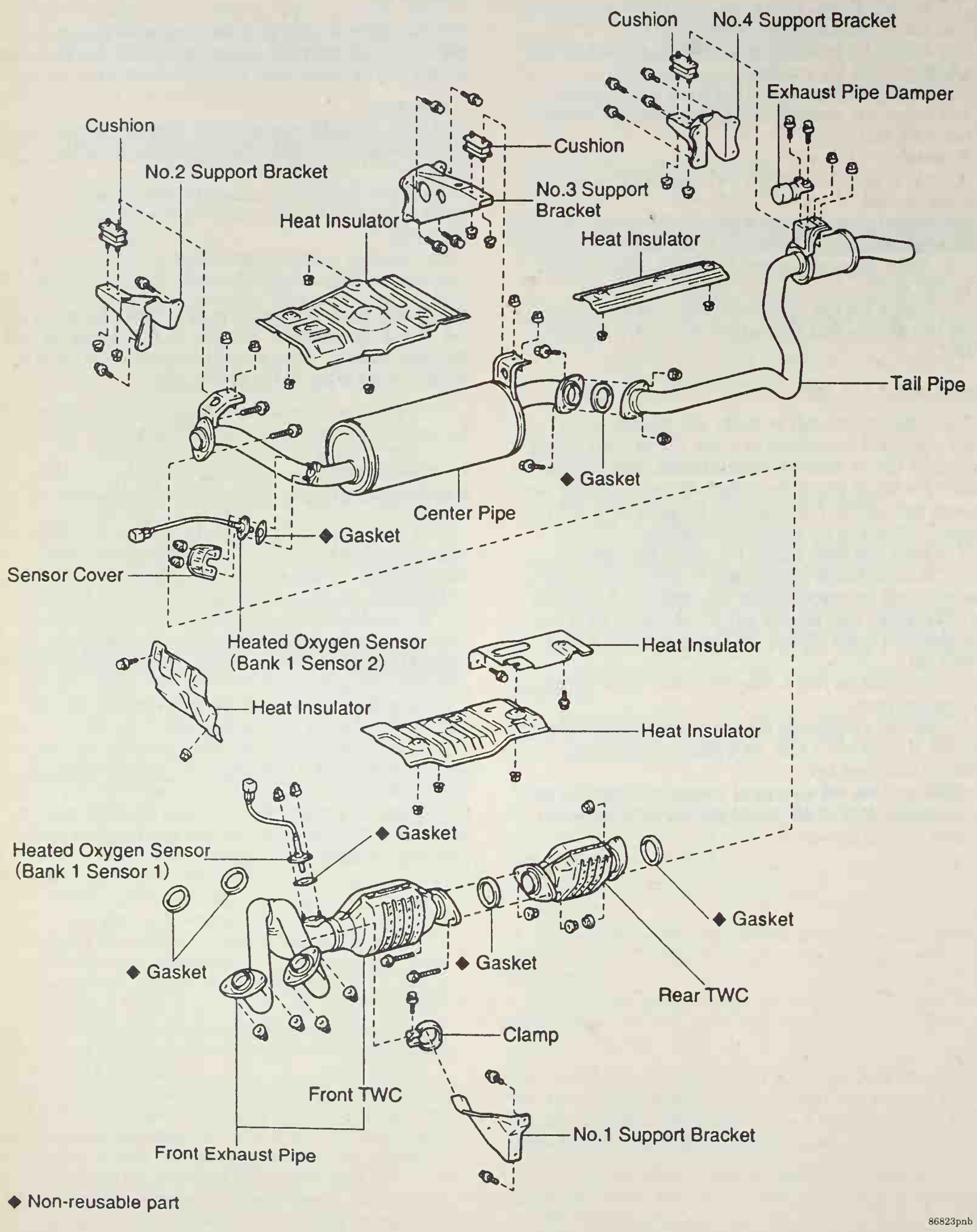

Cushion
No.4 Support Bracket
Exhaust Pipe Damper
Cushion
No.2 Support Bracket
Cushion
No.3 Support Bracket
Heat Insulator
Heat Insulator
Tail Pipe
◆ Gasket
Center Pipe
◆ Gasket
Sensor Cover
Heated Oxygen Sensor
(Bank 1 Sensor 2)
Heat Insulator
Heat Insulator
Heat Insulator
◆ Gasket
Heated Oxygen Sensor
(Bank 1 Sensor 1)
◆ Gasket
◆ Gasket
◆ Gasket
Rear TWC
Clamp
Front TWC
Front Exhaust Pipe
No.1 Support Bracket
◆ Non-reusable part
86823pnb

Fig. 371 Entire exhaust system on the Land Cruiser 1FZ-FE

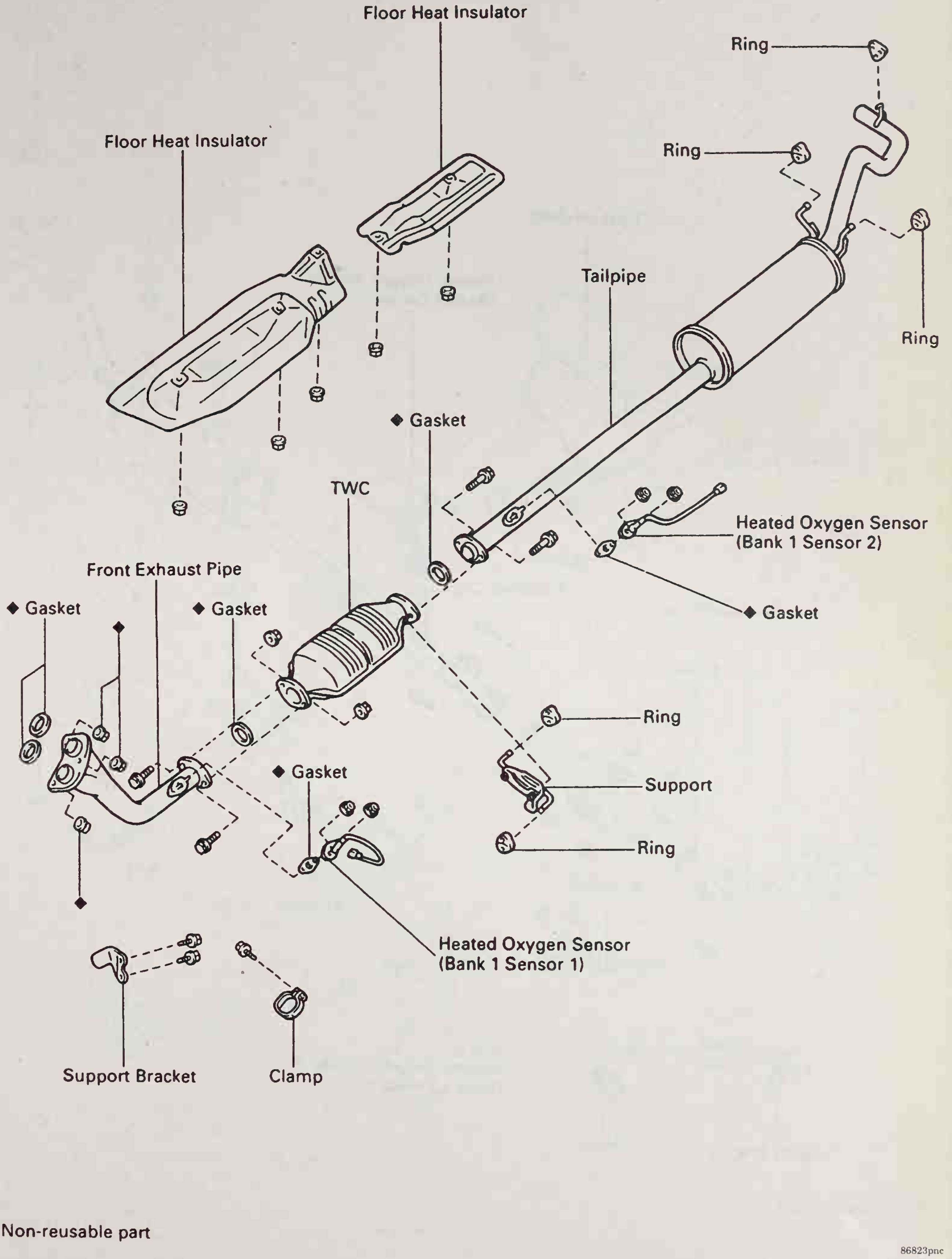

Floor Heat Insulator
Ring
Floor Heat Insulator
Ring
Tailpipe
Ring
◆ Gasket
TWC
Heated Oxygen Sensor
(Bank 1 Sensor 2)
Front Exhaust Pipe
◆ Gasket
◆ Gasket
◆
◆ Gasket
Ring
Support
◆ Gasket
Ring
◆
Heated Oxygen Sensor
(Bank 1 Sensor 1)
Support Bracket
Clamp
◆ Non-reusable part
86823pnc

Fig. 372 Entire exhaust system on the Tacoma 3RZ-FE 4WD

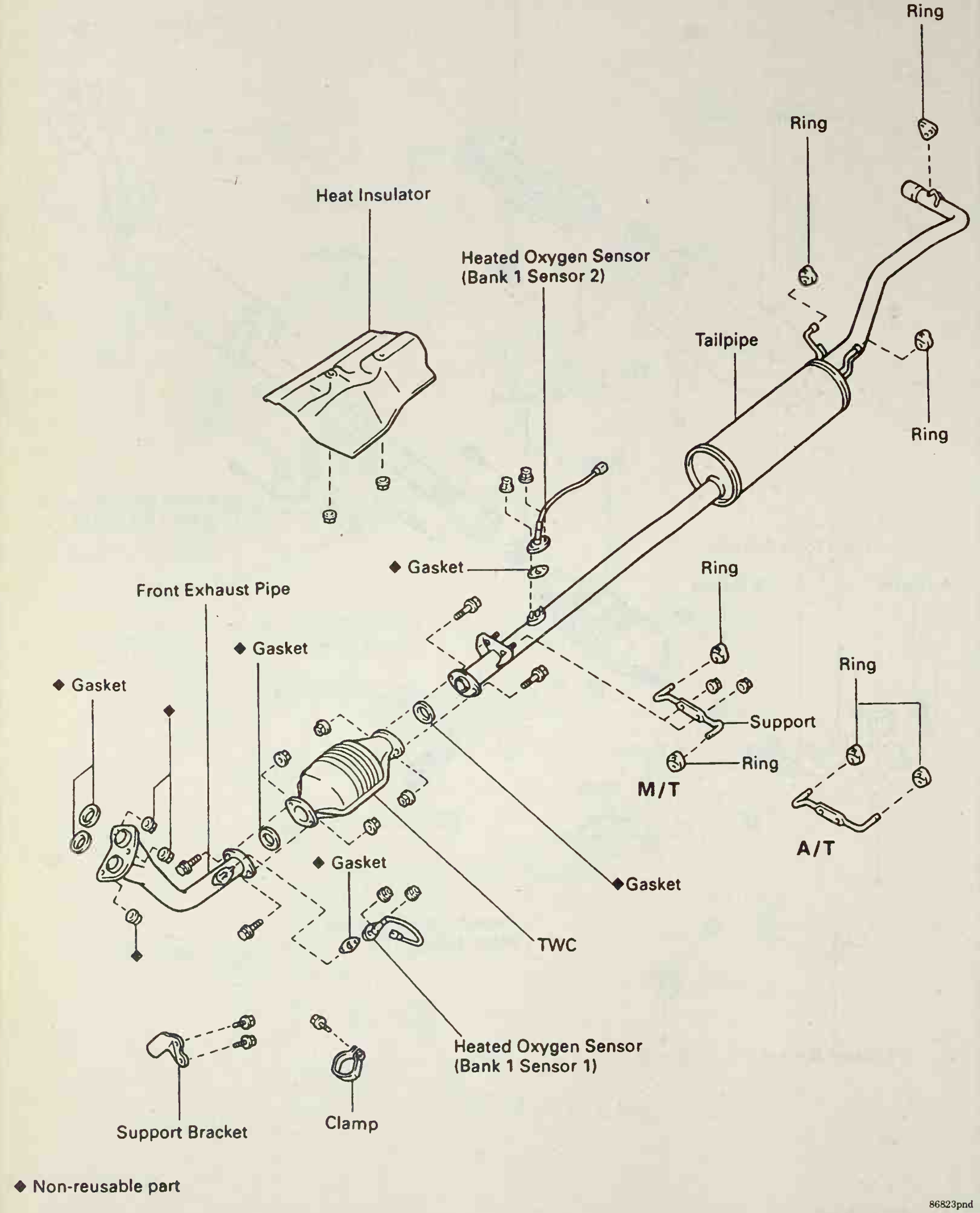

Ring
Ring
Heat Insulator
Heated Oxygen Sensor
(Bank 1 Sensor 2)
Tailpipe
Ring
◆ Gasket
Front Exhaust Pipe
Ring
◆ Gasket
◆ Gasket
Ring
Support
Ring
M/T
A/T
◆ Gasket
◆Gasket
TWC
Heated Oxygen Sensor
(Bank 1 Sensor 1)
Support Bracket
Clamp
◆ Non-reusable part
86823pnd

Fig. 373 Entire exhaust system on the Tacoma 2RZ-FE 2WD

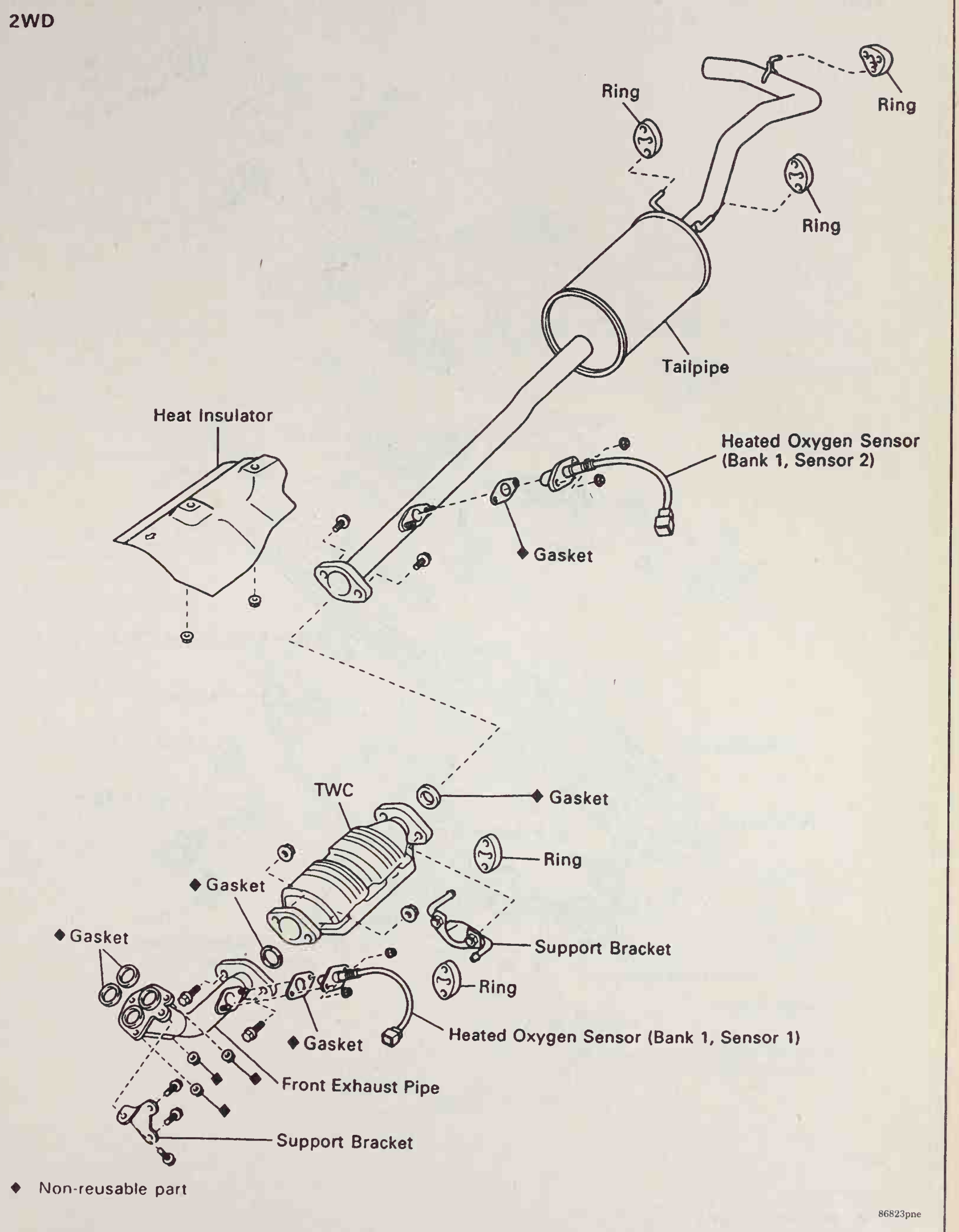

2WD
Ring
Ring
Ring
Tailpipe
Heat Insulator
Heated Oxygen Sensor
(Bank 1, Sensor 2)
◆ Gasket
TWC
◆ Gasket
Ring
◆ Gasket
◆ Gasket
Support Bracket
Ring
◆ Gasket
Heated Oxygen Sensor (Bank 1, Sensor 1)
Front Exhaust Pipe
Support Bracket
◆ Non-reusable part
86823pne

Fig. 374 Entire exhaust system on the Tacoma 5VZ-FE 2WD

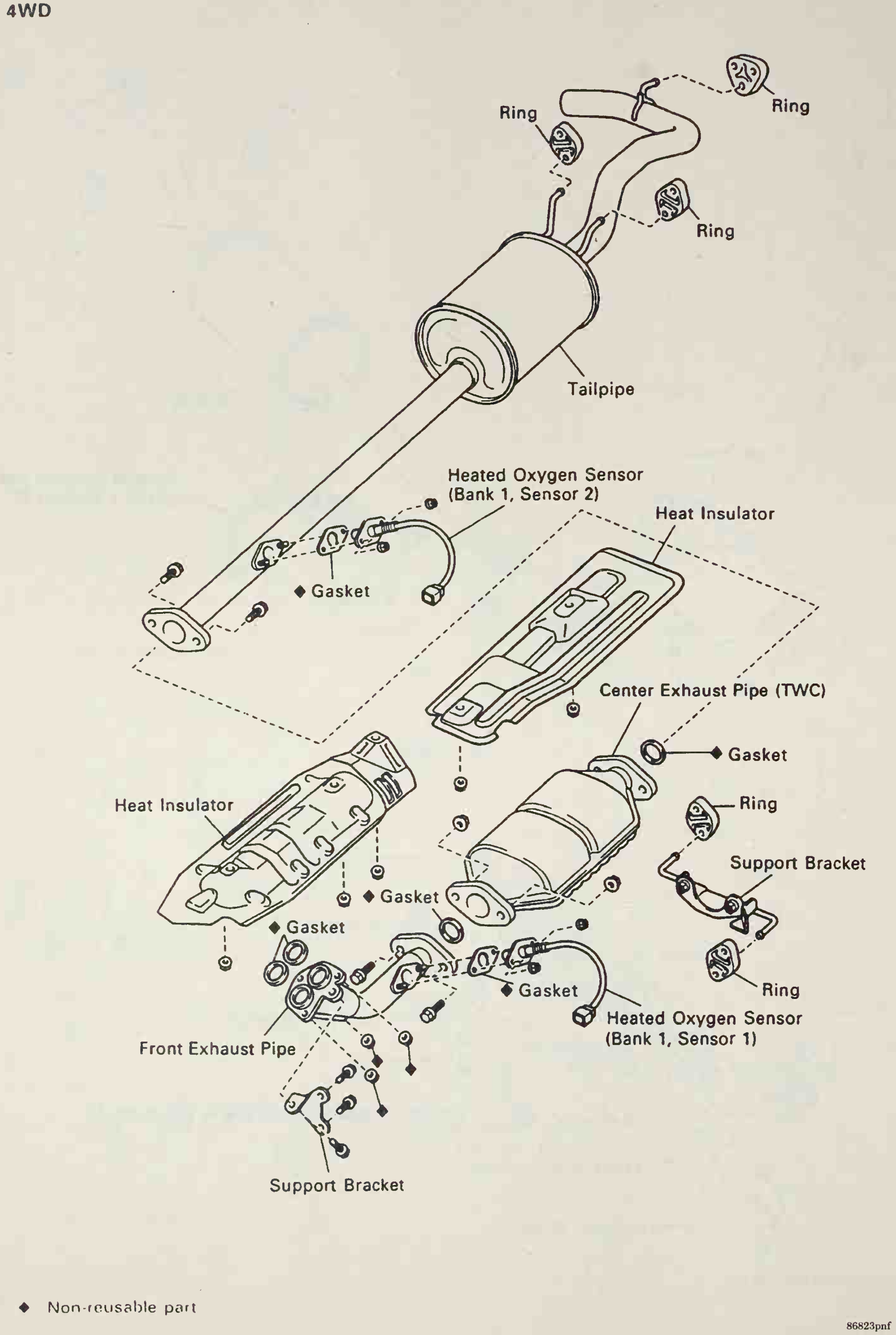

4WD
Ring
Ring
Ring
Tailpipe
Heated Oxygen Sensor
(Bank 1, Sensor 2)
Heat Insulator
◆ Gasket
Center Exhaust Pipe (TWC)
◆ Gasket
Heat Insulator
Ring
Support Bracket
◆ Gasket
◆ Gasket
◆ Gasket
Ring
Heated Oxygen Sensor
(Bank 1, Sensor 1)
Front Exhaust Pipe
Support Bracket
◆ Non-reusable part
86823pnf

Fig. 375 Entire exhaust system on the Tacoma 5VZ-FE 4WD

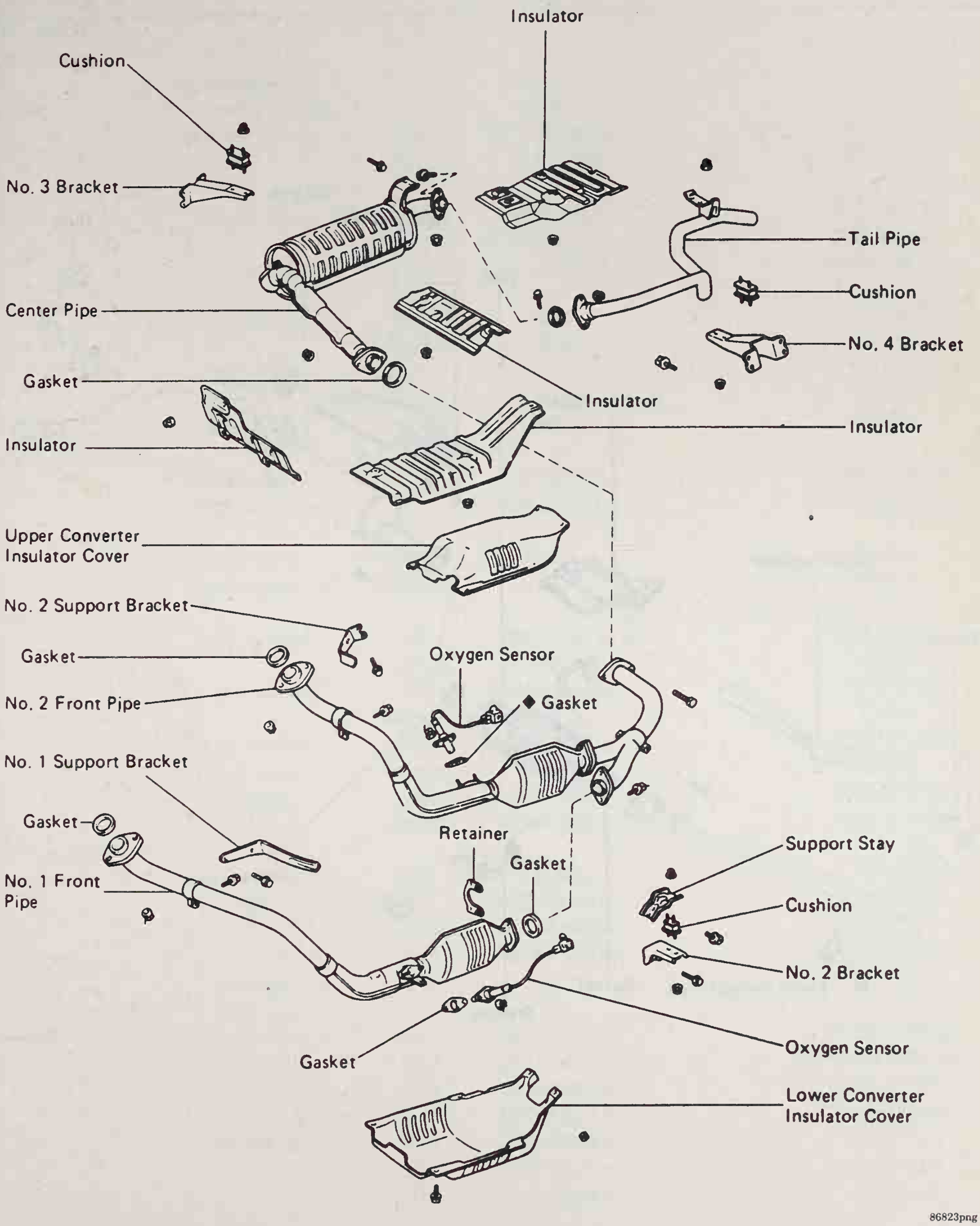

Insulator
Cushion
No. 3 Bracket
Tail Pipe
Cushion
Center Pipe
No. 4 Bracket
Gasket
Insulator
Insulator
Insulator
Upper Converter Insulator Cover
No. 2 Support Bracket
Gasket
Oxygen Sensor
◆ Gasket
No. 2 Front Pipe
No. 1 Support Bracket
Gasket
Retainer
Gasket
Support Stay
No. 1 Front Pipe
Cushion
No. 2 Bracket
Oxygen Sensor
Gasket
Lower Converter Insulator Cover
86823png

Fig. 376 Entire exhaust system on the Land Cruiser 3F-E

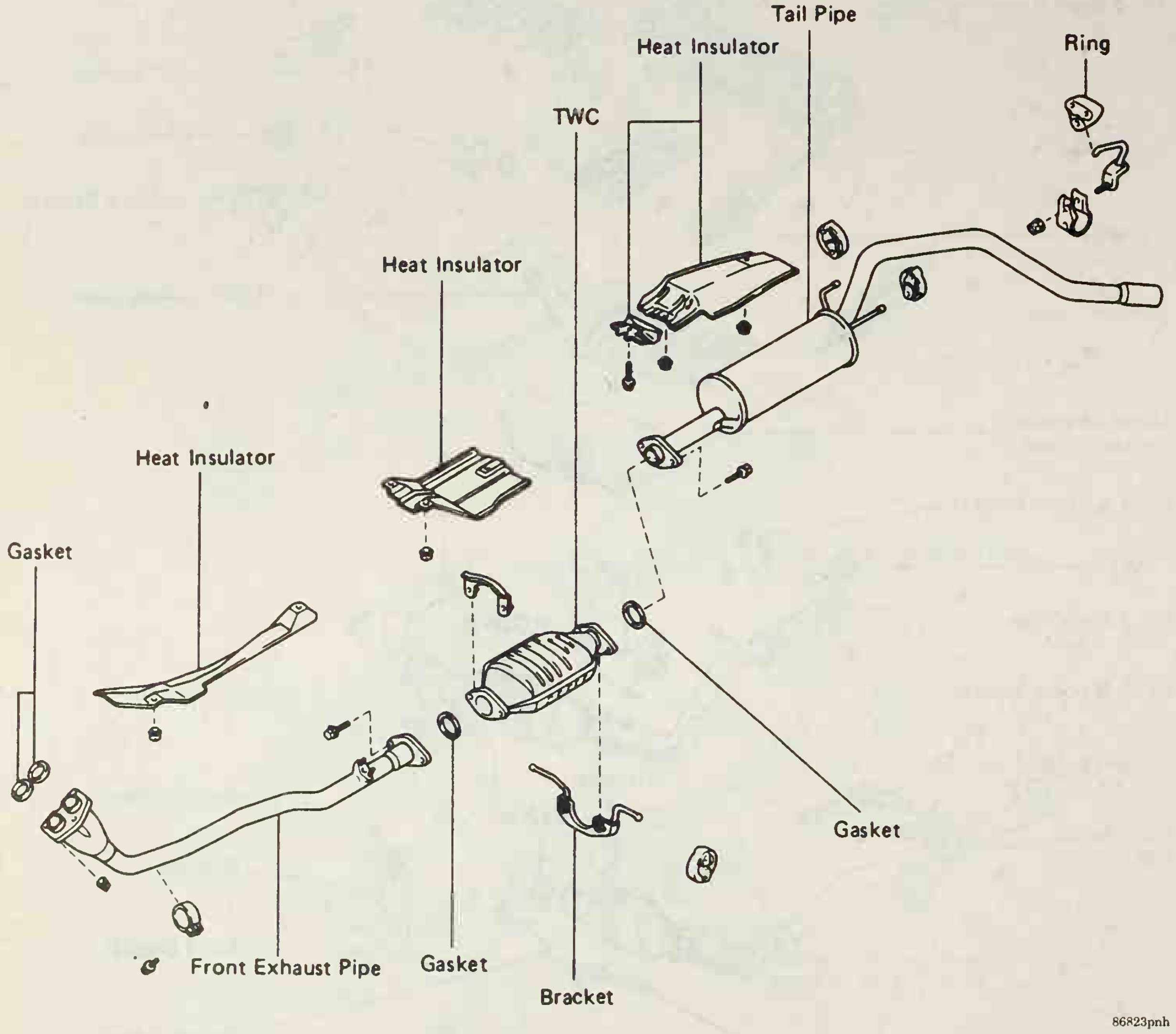

Tail Pipe
Heat Insulator
Ring
TWC
Heat Insulator
Heat Insulator
Gasket
Gasket
Front Exhaust Pipe
Gasket
Bracket
86823pnh

Fig. 377 Entire exhaust system on the Tacoma 3RZ-FE 4WD

ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
22R and 22R-E				
Cylinder head				
	Head surface warpage		0.0059 in.	0.15mm
	Manifold surface warpage		0.0079 in.	0.20mm
	Valve seat refacing	intake	30, 45, 60 degrees	30, 45, 60 degrees
		exhaust	30, 45, 65 degrees	30, 45, 65 degrees
Valve guide bushings				
	Inner diameter	intake	0.3154-0.3161 in.	8.01-8.03mm
		exhaust	0.3154-0.3161 in.	8.01-8.03mm
	Outer diameter		0.5134-0.5138 in.	13.040-13.051mm
Valves				
	Valve overall length	intake	4.468 in.	113.5mm
		exhaust	4.425 in.	112.4mm
	Minimum	intake	4.449 in.	113.0mm
		exhaust	4.406 in.	111.9mm
Valve spring	Free length		1.909 in.	113.5mm
Rocker arm and shaft				
	Inside diameter		0.6299-06306 in.	16.000-16.018mm
	Shaft diameter		0.6287-0.6295 in.	15.97-15.99mm
Chain and sprocket				
	Crankshaft wear	minimum	2.339 in.	59.4mm
	Camshaft wear	minimum	4.480 in.	113.8mm
Camshaft				
	Thrust clearance	STD	0.0031-0.0071 in.	0.08-0.18mm
		maximum	0.0098 in.	0.25mm
	Journal oil clearance	STD	0.0004-0.00020 in.	0.01-0.05mm
		maximum	0.004 in.	0.01mm
	Journal diameter	STD	1.2984-1.2992 in.	32.98-33.00mm
	Circle runout	maximum	0.008 in.	0.02mm
	Cam height	intake	1.6783-1.6891 in.	42.63-42.72mm
		exhaust	1.6807-1.6842 in.	42.69-42.78mm
Cylinder block				
	Head surface warpage	limit	0.0020 in.	0.05mm
	Bore	No. 1	3.6220-3.6224 in.	92.00-92.01mm
		No. 2	3.6224-3.6228 in.	92.01-92.02mm
		No. 3	3.6228-3.6232 in.	92.02-92.03mm
	Bore wear	limit	0.008 in.	0.02mm
Piston and rings				
	Piston diameter	No. 1	3.6211-3.6214 in.	91.975-91-985mm
		No. 2	3.6214-3.6218 in.	91.985-91.995mm
		No. 3	3.6218-3.6222 in.	91.995-92.005mm
	Piston-to-cylinder clearance		0.0006-0.0014 in.	0.015-0.035mm
	Ring end gap	No. 1	0.0098-0.0185 in.	0.25-0.47mm
		No. 2	0.0236-0.0323 in.	0.60-0.82mm
		Oil	0.0079-0.0224 in.	0.20-0.57mm
Connecting rod and bearing				
	Thrust clearance	STD	0.0063-0.0102 in.	0.16-0.26mm
		maximum	0.012 in.	0.3mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
22R and 22R-E				
	Bearing oil clearance	STD	0.0010-0.0022 in.	0.025-0.055mm
		maximum	0.0039 in.	0.10mm
Crankshaft				
	Thrust clearance	STD	0.0008-0.0087 in.	0.02-0.22mm
		maximum	0.012 in.	0.3mm
	Thrust washer clearance		0.1059-0.1079 in.	2.690-2.740mm
	Main journal oil clearance	STD	0.0010-0.0022 in.	0.025-0.055mm
		maximum	0.0031 in.	0.08mm
	Crank pin diameter		2.0861-2.0866 in.	52.988-53.000mm
	Circle runout	maximum	0.004 in.	0.1mm
3VZ-E				
Cylinder				
	Warpage	maximum	0.0039 in.	0.10mm
	Valve seat	refacing	30, 45, 60 degrees	30, 45, 60 degrees
		contacting angle	45 degrees	45 degrees
		contacting width	0.047-0.063 in.	1.2-1.6mm
Valve guide bushings				
	Inside diameter		0.3154-03161 in.	13.040-13.051mm
	Outside diameter		0.5134-0.5138 in.	13.090-13.101mm
Valve				
	Overall length	STD	4.106 in.	104.3mm
		minimum	4.087 in.	103.8mm
	Face angle		44.5 degrees	44.5 degrees
	Stem diameter	intake	0.3138-0.3144 in.	7.970-7.985mm
		exhaust	0.3136-0.3142 in.	7.965-7.980mm
Valve spring				
	Deviation	maximum	0.0484 in.	1.23mm
	Free length	white mark	1.8307 in.	46.50mm
		green mark	1.8508 in.	47.01mm
Camshaft				
	Thrust clearance	STD	0.0031-0.0075 in.	0.080-0.190mm
		maximum	0.0098 in.	0.25mm
	Journal oil clearance	STD	0.0010-0.0026 in.	0.0010-0.0026 in.
		maximum	0.0039 in.	0.10mm
	Journal diameter		1.3370-1.3376 in.	33.959-33.975mm
	Circle runout	maximum	0.0024 in.	0.06mm
Valve lifter				
	Lifter bore diameter		1.4930-1.4934 in.	37.922-37.932mm
			1.4945-1.4951 in.	37.960-37-975mm
	Lifter diameter		1.4945-1.4951 in.	37.960-37.975mm
Air intake chamber				
	Warpage		0.0039 in.	0.10mm
Intake manifold				
	Warpage		0.0039 in.	0.10mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
3VZ-E				
Block				
	Bore diameter-STD	Mark 1	3.4449-3.4453 in.	87.500-87.510mm
		Mark 2	3.4453-3.4457 in.	87.510-87.520mm
		Mark 3	3.4457-3.4461 in.	87.520-87.530mm
Piston and ring				
	Diameter-STD	Mark 1	3.4394-3.4398 in.	87.360-87.370mm
		Mark 2	3.4398-3.4402 in.	87.370-87.380mm
		Mark 3	3.4402-3.4405 in.	87.380-87.390mm
	Oil clearance	STD	0.0051-0.0059 in.	0.130-0.150mm
		maximum	0.0067 in.	0.17mm
	Ring groove clearance	No. 1	0.0008-0.0024 in.	0.020-0.060mm
		No. 2	0.0012-0.0028 in.	0.030-0.070mm
		maximum	0.0079 in.	0.20mm
Connecting rod				
	Thrust clearance	STD	0.0059-0.0130 in.	0.150-0.330mm
		maximum	0.0150 in.	0.38mm
Crankshaft				
	Thrust clearance	STD	0.0008-0.0087 in.	0.020-0.220mm
		maximum	0.0118 in.	0.30mm
Crankshaft				
	Thrust washer thickness		0.0961-0.0980 in.	2.440-2.490mm
	Main journal oil clearance	No. 1 STD	0.0010-0.0020 in.	0.0025-0.0052mm
	Journal diameter	STD	2.5190-2.5197 in.	63.996-64.000mm
	Referance-STD	Mark 0	2.5195-2.5197 in.	63.996-64.000mm
		Mark 1	2.5193-2.5195 in.	63.990-63.996mm
		Mark 2	2.5191-2.5193 in.	63.985-63.990mm
	Circle runout	maximum	0.0024 in.	0.06mm
5VZ-FE				
Valve clearance	Intake	cold	0.006-0.009 in.	0.13-0.23mm
	Exhaust	cold	0.011-0.014 in.	0.27-0.37mm
Cylinder head	Warpage	maximum	0.039 in.	0.10mm
	Valve seat	refacing	30, 45, 60 degrees	30, 45, 60 degrees
		contacting angle	45 degrees	45 degrees
		contacting width	0.039-0.055 in.	1.0-1.4mm
Valve guide bushing				
	Inside diameter		0.2366-0.2374 in.	6.010-6.030mm
	Outside diameter		0.4344-0.4348 in.	11.033-11.044mm
Valve				
	Face angle		45 degrees	45 degrees
	Stem diameter	intake	0.2350-0.2356 in.	5.970-5.985mm
		exhaust	0.2348-0.2354 in.	5.965-5.980mm
Valve spring				
	Deviation	maximum	0.079 in.	2.0mm
	Free length		1.7630 in.	44.78mm
Valve lifter				
	Diameter		1.2191-2.2195 in.	30.966-30.976mm
	Bore diameter		1.2205-1.2212 in.	31.000-31.018mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
5VZ-FE				
Camshaft				
	Thrust clearance	STD	0.0013-0.0031 in.	0.033-0.080mm
		maximum	0.0047 in.	0.12mm
	Journal diameter	STD	0.0014-0.0028 in.	0.035-0.072mm
	Circle runout	maximum	0.0024 in.	0.06mm
	Cam lobe height	intake	1.6657-1.6697 in.	42.31-42.41mm
		exhaust	1.6520-1.6559 in.	41.96-42.06mm
	Gear backlash	STD	0.0008-0.0078 in.	0.020-0.200mm
		maximum	0.0188 in.	0.30mm
Block				
	Head surface warpage	maximum	0.0020 in.	0.05mm
	Bore diameter-STD	Mark 1	3.6811-3.6815 in.	93.500-93.510mm
		Mark 2	3.6815-3.6819 in.	93.510-93.520mm
		Mark 3	3.6819-3.6823 in.	9320-93.530mm
Piston and ring				
	Diameter-STD	Mark 1	3.6754-3.6758 in.	93.356-93.366mm
		Mark 2	3.6759-3.6762 in.	93-367-93.376mm
		Mark 3	3.6763-3.6766 in.	93-377-93-386mm
	Oil clearance	STD	0.0053-0.0060 in.	0.134-0.154mm
		maximum	0.0069 in.	0.174mm
Connecting rod				
	Thrust clearance	STD	0.0059-0.0130 in.	0.150-0.330mm
		maximum	0.0150 in.	0.380mm
Connecting rod				
	Rod oil clearance	STD	0.0009-0.0021 in.	0.024-0.53mm
		maximum	0.0031 in.	0.08mm
	Rod bend	per 100mm	0.0020 in.	0.05mm
	Rod twist	per 100mm	0.0059 in.	0.15mm
	Pin diameter		0.8660-0.8665 in.	21.997-22.009mm
Crankshaft				
	Thrust clearance	STD	0.0008-0.0087 in.	0.020-0.220mm
		maximum	0.0150 in.	0.380mm
	Thrust washer thickness		0.0961-0.0980 in.	2.440-2.490mm
	Main journal oil clearance	STD-No. 1	0.0008-0.0015 in.	0.020-0.038mm
		STD-others	0.0009-0.0017 in.	0.024-0.042mm
		maximum	0.0031 in.	0.08mm
	Crank pin diameter		2.1648-2.1654 in.	54.987-55.000mm
	Circle runout	maximum	0.0024 in.	0.06mm
2RZ-FE and 3RZ-FE				
Valve clearance				
	Intake		0.006-0.010 in.	0.15-0.25mm
	Exhasut		0.010-0.014 in.	0.25-0.35mm
Cylinder head				
	Valve seat refacing	intake	30, 45, 60 degrees	30, 45, 60 degrees
		exhaust	45, 60 degrees	45, 60 degrees
	Contacting angle		45 degrees	45 degrees
	Contacting width		0.039-0.055 in.	1.0-1.4mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
2RZ-FE and 3RZ-FE				
Valve guide bushing				
	Inside diameter		0.2366-0.2374 in.	6.010-6.030mm
	Protrusion height		0.323-0.339 in.	8.2-8.6mm
Valve				
	Overall length	intake	4.0728 in.	103.45mm
		exhaust	4.0787 in.	103.60mm
	Face angle		44.5 degrees	44.5 degrees
	Stem diameter	intake	0.2350-0.2356 in.	5.970-5.985mm
		exhaust	0.2348-0.2354 in.	5.965-5.980mm
Valve spring				
	Deveation	maximum	0.079 in.	2.0mm
Valve lifter				
	Diameter		1.1578-1.2195 in.	30.966-30.976mm
	Bore diameter		1.2205-1.2211 in.	31.000-31.016mm
	Oil clearance		0.0009-0.0020 in.	0.024-0.050mm
Camshaft				
	Thrust clearance	STD	0.0016-0.0037 in.	0.040-0.095mm
		maximum	0.0047 in.	0.12mm
	Journal diameter		1.0614-1.0620 in.	26.959-26.975mm
	Circle runout	maximum	0.0024 in.	0.06mm
	Cam lobe height	intake	1.7839-1.7878 in.	45.31-45.41mm
	Cam lobe height	exhaust	1.7740-1.7779 in.	45.06-45.16mm
	Camshaft gear backlash	STD	0.0008-0.0079 in.	0.020-0.200mm
		maximum	0.0188 in.	0.30mm
	Gear spring end free distance		0.886-0.902 in.	22.5-22.9mm
Spark plug tube				
	Protrution		1.850 in.	47.0mm
Block				
	Cylinder bore diameter	STD	3.7400-3.7403	94.990-95.003mm
		maximum	3.7425	95.06mm
Piston and ring				
	Piston diameter	2RZ-FE	3.7371-3.7375 in.	94.923-94.933mm
		3RZ-FE	3.7375-3.7379 in.	94.933-94.943mm
	Oil clearance	2RZ-FE	0.0022-0.0031 in.	0.057-0.080mm
		3RZ-FE	0.0019-0.0028 in.	0.047-0.070mm
Connecting rod				
	Thrust clearance	STD	0.0063-0.0123 in.	0.160-0.312mm
		maximum	0.0138 in.	0.35mm
	Oil clearance	STD	0.0012-0.0022 in.	0.030-0.050mm
		maximum	0.0039 in.	0.10mm
	Pin diameter		0.9449-0.9452 in.	24.000-24.009mm
Crankshaft				
	Thrust clearance	STD	0.008-0.0087 in.	0.020-0.0220mm
		maximum	0.0118 in.	0.30mm
	Main journal oil clearance	STD-No. 3	0.0012-0.0022 in.	0.030-0.055mm
		others	0.0009-0.0019 in.	0.024-0.049mm
	Journal diameter	STD-No. 3	2.2615-2.3620 in.	59.981-59.994mm
		others	2.3617-2.3622 in.	59.987-60.000mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
2RZ-FE and 3RZ-FE				
Crankshaft				
	Crank pin diameter		2.0861-2.0866 in.	52.987-53.000mm
	Circle runout	maximum	0.0012 in.	0.03mm
Balance shaft	Thrust clearance	STD	0.0027-0.0051 in.	0.07-0.13mm
		maximum	0.0079 in.	0.20mm
	Oil clearance	No. 1	0.0016-0.0031 in.	0.040-0.076mm
		No. 2	0.0024-0.0038 in.	0.060-0.096mm
		maximum	0.0059 in.	0.15mm
1FZ-FE				
Valve clearance				
	Cold	intake	0.006-0.010 in.	0.15-0.25mm
		exhaust	0.010-0.014 in.	0.25-0.35mm
Cylinder head				
	Valve seat refacing	intake	30, 45, 75 degrees	30, 45, 75 degrees
		exhaust	45, 75 degrees	45, 75 degrees
	Contacting angle		45 degree	45 degree
	Contacting width	intake	0.047-0.063 in.	1.2-1.6mm
		exhaust	0.039-0.055 in.	1.0-1.4mm
Valve guide bushings				
	Inside diameter		0.2760-0.2768 in.	7.010-7.030mm
	Protrution height		0.323-0.339 in.	8.2-8.6mm
Valve				
	Overall length	intake	3..874 in.	98.4mm
		exhaust	3.854 in.	97.9mm
	Face angle		45 degrees	45 degrees
	Stem diameter	intake	0.2744-0.2750 in.	6.970-6.985mm
		exhaust	0.2742-0.2748 in.	6.965-6.980mm
Valve spring				
	Deviation	maximum	0.079 in.	2.0mm
	Free length		1.7299-1.7740 in.	43.94-45.06mm
Valve lifter				
	Lift diameter		1.3372-1.3376 in.	33.966-33.976mm
	Bore diameter		1.3386-1.3394 in.	34.000-34.021mm
	Oil clearance	STD	0.0009-0.0022 in.	0.024-0.055mm
		maximum	0.0028 in.	0.07mm
Camshaft				
	Thrust clearance	STD	0.0012-0.0031 in.	0.030-0.080mm
		maximum	0.0039 in.	0.10mm
	Oil clearance	STD	0.010-0.0024 in.	0.025-0.062mm
		maximum	0.0039 in.	0.10mm
	Journal diameter		1.0614-1.0620 in.	26.959-26.975mm
	Circle runout	maximum	0.0024 in.	0.06mm
	Cam lobe height	STD	1.9925-1.9965 in.	50.61-50-71mm
		maximum	1.9886 in.	50.51mm
	Gear backlash	STD	0.0008-0.0079 in.	0.020-0.200mm
		maximum	0.0188 in.	0.30mm

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ENGINE REBUILDING SPECIFICATIONS

Component			U.S.	Metric
1FZ-FE				
Spark plug tube				
	Protrusion		1.791 in.	45.5mm
Oil pump drive shaft gear				
		STD	0.0016-0.0063 in.	0.040-0.160mm
		maximum	0.0118 in.	0.30mm
Chain and timing gear				
	Chain length at 16 links	maximum	5.772 in.	146.6mm
Block				
	Bore diameter	STD Mark 1	3.9370-3.9374 in.	100.000-100.010mm
		Mark 2	3.9374-3.9378 in.	100.010-100.020mm
		Mark 3	3.9378-3.9382 in.	100.020-100.030mm
		STD maximum	3.9461 in.	100.23mm
	Main bearing dia. outside	STD	0.4271-0.4331 in.	10.85-11.00mm
		maximum	0.417 in.	10.6mm
Piston and ring				
	Piston diameter	STD Mark 1	3.9350-3.9354 in.	99.950-99.960mm
		Mark 2	3.9354-3.9358 in.	99.960-99.970mm
		Mark 3	3.9358-3.9362 in.	99.970-99.980mm
	Oil clearance	STD	0.0016-0.0024 in.	0.040-0.060mm
	Ring end gap	STD No. 1	0.0118-0.0205 in.	0.300-0.520mm
		No. 2	0.0177-0.0264 in.	0.450-0.670mm
		Oil	0.0059-0.0205 in.	0.150-0.520mm
		maximum No. 1	0.0441 in.	1.12mm
		No. 2	0.0461 in.	1.17mm
		Oil	0.0441 in.	1.12mm
Connecting rod				
	Thrust clearance	STD	0.0063-0.0103 in.	0.160-0.262mm
		maximum	0.0143 in.	0.362mm
	Rod oil clearance	STD	0.0013-0.0020 in.	0.032-0.050mm
		maximum	0.0013-0.0029 in.	0.033-0.073mm
	Piston pin diameter		1.0236-1.0241 in.	26.000-26.012mm
	Pin oil clearance	STD	0.0002-0.0005 in.	0.004-0.012mm
		limit	0.0020 in.	0.05mm
	Rod bolt	STD	0.3307-0.3386 in.	8.40-8.60mm
		maximum	0.3150 in.	8.0mm
Crankshaft				
	Thrust clearance	STD	0.0008-0.0087 in.	0.20-0.220mm
		maximum	0.0118 in.	0.30mm
	Thrust washer thickness	STD	0.0961-0.0980 in	2.440-2.490mm
		O/S 0.125	0.0985-0.1005 in.	2.503-2.553mm
		O/S 0.250	0.1010-0.1030 in.	2.562-2.615mm
	Journal oil clearance	STD	0.0017-0.0024 in.	0.042-0.060mm
		U/S 0.25	0.0016-0.0032 in.	0.041-0.081mm
	Crank pin diameter	STD	2.2434-2.2441 in.	56.982-57.000mm
		maximum	0.0024 in.	0.06mm

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TORQUE SPECIFICATIONS

Compnant	U.S.	Metric
22R		
Cylinder head-to-cylinder bock	58 ft. lbs.	78 Nm
Intake manifold-to-cylinder head	14 ft. lbs.	19 Nm
Exhaust manifold-to-cylinder head	33 ft. lbs.	44 Nm
Crankshaft bearing cap-to-cylinder block	76 ft. lbs.	103 Nm
Connecting rod cap-to-connecting rod	51 ft. lbs.	69 Nm
Crankshaft pulley-to-crankshaft	116 ft. lbs.	157 Nm
Flywheel-to-cranksahft	80 ft. lbs.	108 Nm
Camshaft bearing cap-to-cylinder head	14 ft. lbs.	20 Nm
Oil pan-to-block	9 ft. lbs.	13 Nm
22R-E		
Cylinder head-to-valve cover	52 inch lbs.	6 Nm
Cylinder head-to-camshaft bearing cap	14 ft. lbs.	20 Nm
Cylinder head-to-spark plug	13 ft. lbs.	18 Nm
Cylinder head-to-intake manifold	14 ft. lbs.	19 Nm
Cylinder head-to-exhaust manifold	33 ft. lbs.	44 Nm
Cylinder head-to-head rear cover	9 ft. lbs.	13 Nm
Block-to-chain dampner	16 ft. lbs.	22 Nm
Block-to-cylinder head	58 ft. lbs.	78 Nm
Block-to-enigne mounting	29 ft. lbs.	39 Nm
Block-to-rear seal retainer	13 ft. lbs.	18 Nm
Oil cooler relief valve-to-block	51 ft. lbs.	69 Nm
Block-to-crankshaft bearing cap	76 ft. lbs.	103 Nm
Block-to-oil strainer	9 ft. lbs.	13 Nm
Block-to-oil pan	9 ft. lbs.	13 Nm
Valve clearance adjusting screw	18 ft. lbs.	25 Nm
Crankshaft pulley-to-No. 2 pulley	14 ft. lbs.	19 Nm
Air intake chamber-to-intake manifold	14 ft. lbs.	19 Nm
Connecting rod-to-connecting rod cap	51 ft. lbs.	69 Nm
Crankshaft-to-crankshaft-to-pulley	116 ft. lbs.	157 Nm
Crankshaft-to-flywheel	80 ft. lbs.	108 Nm
Crankshaft-to-drive plate	61 ft. lbs.	83 Nm
Oil pan-to-drain plug	18 ft. lbs.	25 Nm
3VZ-E		
No. 1 idler pulley-to-cylinder head	25 ft. lbs.	34 Nm
Crankshaft pulley-to-crankshaft	181 ft. lbs.	245 Nm
Camshaft pulley-to-camshaft	80 ft. lbs.	108 Nm
Fan bracket-to-block	30 ft. lbs.	41 Nm
Cooling fan-to-coupling	48 inch lbs.	5 Nm
Water outlet-to-No. 2 idler pulley	74 inch lbs.	8 Nm
Cylinder head-to-spark plug	13 ft. lbs.	18 Nm
Exhaust manifold-to-cylinder head	29 ft. lbs.	39 Nm
Cylinder head-to-block		
12 pointed head (1st)	33 ft. lbs.	44 Nm
(2nd)	Turn 90 degrees	Tum 90 degrees
(3rd)	Turn 90 degrees	Tum 90 degrees

86823C11

TORQUE SPECIFICATIONS

Compnant	U.S.	Metric
3VZ-E		
6 pointed head	30 ft. lbs.	41 Nm
	12 ft. lbs.	16 Nm
Valve cover-to-cylinder head	48 inch lbs.	5 Nm
Engine crossover pipe-to-exhaust manifold	29 ft. lbs.	39 Nm
Intake manifold-to-cylinder head	13 ft. lbs.	18 Nm
No. 3 timing belt cover-to-cylinder head	74 inch lbs.	8 Nm
No. 2 idler pulley-to-intake manifold	13 ft. lbs.	18 Nm
No. 4 timing belt cover-to-No. 3 cover	74 inch lbs.	8 Nm
Air intake chamber-to-intake manifold	13 ft. lbs.	18 Nm
Oil pump-to-block	14 ft. lbs.	20 Nm
Oil pan-to-block	52 inch lbs.	6 Nm
Water pump-to-block		
short bolt	14 ft. lbs.	20 Nm
long bolt	13 ft. lbs.	18 Nm
Crankshaft-to-flywheel	65 ft. lbs.	88 Nm
Crankshaft-to-driveplate	61 ft. lbs.	83 Nm
5VZ-FE		
No. 1 idler pulley-to-oil pump	26 ft. lbs.	35 Nm
No. 1 timing belt cover-to-oil pump	80 inch lbs.	9 Nm
Crankshaft pulley-to-crankshaft	184 ft. lbs.	250 Nm
Camshaft timing pulley-to-camshaft	81 ft. lbs.	110 Nm
No. 2 timing belt cover-to-No. 3 belt cover	80 inch lbs.	9 Nm
Camshaft bearing cap-to-cylinder head	12 ft. lbs.	16 Nm
Cylinder head rear plate-to-head	71 inch lbs.	8 Nm
Exhaust manifold-to-cylinder head	30 ft. lbs.	40 Nm
Intake manifold-to-cylinder head	13 ft. lbs.	18 Nm
No. 3 timing belt cover-to-cylinder head	80 inch lbs.	9 Nm
Camshaft position sensor-to-cylinder head	71 inch lbs.	8 Nm
Connecting rod cap-to-connecting rod		
(1st)	18 ft. lbs.	25 Nm
(2nd)	Turn 90 degrees	Turn 90 degrees
Main bearing cap-to-block		
(1st)	45 ft. lbs.	61 Nm
(2nd)	Turn 90 degrees	Turn 90 degrees
Rear oil seal retainer-to-block	71 inch lbs.	8 Nm
Rear end plate-to-block	66 inch lbs.	7 Nm
Driveplate-to-crankshaft	61 ft. lbs.	83 Nm
Flywheel-to-crankshft	63 ft. lbs.	85 Nm
2RZ-FE and 3RZ-FE		
Cylinder head-to-timing chain cover	15 ft. lbs.	21 Nm
Camshaft bearing cap-to-cylinder head	12 ft. lbs.	16 Nm
Camshaft timing gear-to-intake camshaft	54 ft. lbs.	74 Nm
No. 1 chain tensioner-to-cylinder head	15 ft. lbs.	21 Nm
Cylinder head rear cover-to-head	10 ft. lbs.	13 Nm
Exhaust manifold-to-cylinder head	36 ft. lbs.	49 Nm

86823C12

TORQUE SPECIFICATIONS

Compnant		U.S.	Metric
2RZ-FE and 3RZ-FE			
Intake manifold-to-cylinder head		22 ft. lbs.	29 Nm
Air intake chamber-to-intake manifold		15 ft. lbs.	20 Nm
Balance shaft drive gear-to-balance shaft		18 ft. lbs.	25 Nm
Timing chain cover-to-block			
12mm head bolt	A	14 ft. lbs.	20 Nm
	B	18 ft. lbs.	25 Nm
14mm head	bolt	32 ft. lbs.	44 Nm
	nut	14 ft. lbs.	20 Nm
Crankshaft pulley-to-cranksahft		193 ft. lbs.	260 Nm
Oil pan-to-block		9 ft. lbs.	13 Nm
Stiffener plate-to-block		27 ft. lbs.	37 Nm
Connecting rod cap-to-connecting rod			
	(1st)	33 ft. lbs.	45 Nm
	(2nd)	Turn 90 degrees	Turn 90 degrees
Main bearing cap-to-block			
	(1st)	29 ft. lbs.	39 Nm
	(2nd)	Turn 90 degrees	Turn 90 degrees
No. 1 balance shaft-to-timing gear		26 ft. lbs.	36 Nm
Balance shaft-to-block		13 ft. lbs.	18 Nm
Rear oil seal retainer-to-block		10 ft. lbs.	14 Nm
Rear end plate-to-block		13 ft. lbs.	18 Nm
Flywheel-to-cranksahft	2RZ-FE	65 ft. lbs.	88 Nm
	3RZ-FE		
	(1st)	19 ft. lbs.	27 Nm
	(2nd)	Turn 90 degrees	Turn 90 degrees
Driveplate-to-crankshaft		54 ft. lbs.	74 Nm
3F-E			
Cylinder head-to-block		90 ft. lbs.	123 Nm
Valve rocker support-to-head			
12mm bolt head		17 ft. lbs.	24 Nm
14mm head bolt and nut		25 ft. lbs.	33 Nm
Manifold-to-cylinder head			
14mm bolt head		37 ft. lbs.	50 Nm
17mm head bolt		51 ft. lbs.	69 Nm
nut		41 ft. lbs.	56 Nm
Valve cover-to-cylinder head		78 inch lbs.	9 Nm
Intake manifold-to-intake stay		22 ft. lbs.	29 Nm
Block-to-intake stay		22 ft. lbs.	29 Nm
Exhaust manifold-to-exhaust pipe		46 ft. lbs.	62 Nm
Camshaft thrust washer-to-block		9 ft. lbs.	12 Nm
Crankshaft pulley-to-crankshaft		253 ft. lbs.	343 Nm
Pushrod cover-to-block		35 inch lbs.	4 Nm
Connecting rod cap-to-connecting rod		43 ft. lbs.	59 Nm
Driveplate-to-crankshaft		64 ft. lbs.	87 Nm

86823C13

TORQUE SPECIFICATIONS

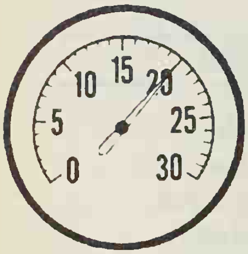
Compnant		U.S.	Metric
1FZ-FE			
Air intake chamber-to-intake manifold		15 ft. lbs.	21 Nm
Cylinder head-to-block	(1st)	29 ft. lbs.	39 Nm
	(2nd)	Turn 90 degrees	Turn 90 degrees
	(3rd)	Turn 90 degrees	Turn 90 degrees
Cylinder head-to-timing chain		15 ft. lbs.	21 Nm
Camshaft bearing cap-to-cylinder head		12 ft. lbs.	16 Nm
Camshaft timing gear-to-camshaft		54 ft. lbs.	74 Nm
Chain tensioner-to-cylinder head		15 ft. lbs.	21 Nm
Exhaust manifold-to-cylinder head		29 ft. lbs.	39 nm
Front exhaust pipe-to-rear TWC		34 ft. lbs.	46 Nm
Vibration damper-to-block		14 ft. lbs.	20 Nm
Timing chain cover-to-block		15 ft. lbs.	21 Nm
Crankshaft pulley-to-crankshaft		304 ft. lbs.	412 Nm
Water pump-to-block		15 ft. lbs.	21 Nm
Rear oil seal retainer-to-block		15 ft. lbs.	21 Nm
Driveplate-to-crankshaft		74 ft. lbs.	100 Nm
Transmission-to-block		53 ft. lbs.	72 Nm

86823C14

USING A VACUUM GAUGE

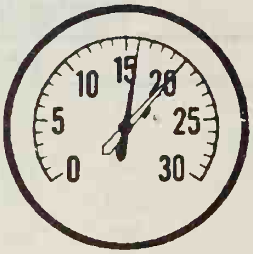
White needle = steady needle ***Dark needle = drifting needle***

The vacuum gauge is one of the most useful and easy-to-use diagnostic tools. It is inexpensive, easy to hook up, and provides valuable information about the condition of your engine.



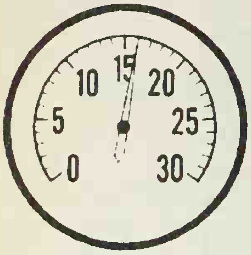
Indication: Normal engine in good condition

Gauge reading: Steady, from 17-22 in./Hg.



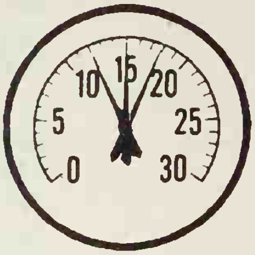
Indication: Sticking valve or ignition miss

Gauge reading: Needle fluctuates from 15-20 in./Hg. at idle



Indication: Late ignition or valve timing, low compression, stuck throttle valve, leaking carburetor or manifold gasket.

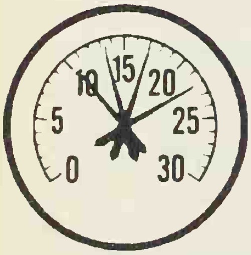
Gauge reading: Low (15-20 in./Hg.) but steady



Indication: Improper carburetor adjustment, or minor intake leak at carburetor or manifold

NOTE: Bad fuel injector O-rings may also cause this reading.

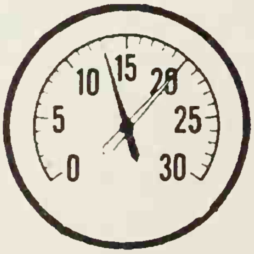
Gauge reading: Drifting needle



Indication: Weak valve springs, worn valve stem guides, or leaky cylinder head gasket (vibrating excessively at all speeds).

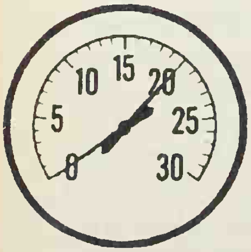
NOTE: A plugged catalytic converter may also cause this reading.

Gauge reading: Needle fluctuates as engine speed increases



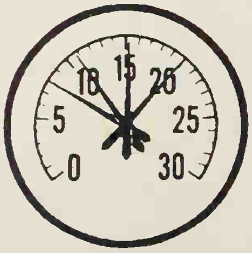
Indication: Burnt valve or improper valve clearance. The needle will drop when the defective valve operates.

Gauge reading: Steady needle, but drops regularly



Indication: Choked muffler or obstruction in system. Speed up the engine. Choked muffler will exhibit a slow drop of vacuum to zero.

Gauge reading: Gradual drop in reading at idle



Indication: Worn valve guides

Gauge reading: Needle vibrates excessively at idle, but steadies as engine speed increases

tccs3c01

Troubleshooting Engine Mechanical Problems

Problem	Cause	Solution
External oil leaks	• Cylinder head cover RTV sealant broken or improperly seated	• Replace sealant; inspect cylinder head cover sealant flange and cylinder head sealant surface for distortion and cracks
	• Oil filler cap leaking or missing	• Replace cap
	• Oil filter gasket broken or improperly seated	• Replace oil filter
	• Oil pan side gasket broken, improperly seated or opening in RTV sealant	• Replace gasket or repair opening in sealant; inspect oil pan gasket flange for distortion
	• Oil pan front oil seal broken or improperly seated	• Replace seal; inspect timing case cover and oil pan seal flange for distortion
	• Oil pan rear oil seal broken or improperly seated	• Replace seal; inspect oil pan rear oil seal flange; inspect rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove
	• Timing case cover oil seal broken or improperly seated	• Replace seal
	• Excess oil pressure because of restricted PCV valve	• Replace PCV valve
	• Oil pan drain plug loose or has stripped threads	• Repair as necessary and tighten
	• Rear oil gallery plug loose	• Use appropriate sealant on gallery plug and tighten
	• Rear camshaft plug loose or improperly seated	• Seat camshaft plug or replace and seal, as necessary
Excessive oil consumption	• Oil level too high	• Drain oil to specified level
	• Oil with wrong viscosity being used	• Replace with specified oil
	• PCV valve stuck closed	• Replace PCV valve
	• Valve stem oil deflectors (or seals) are damaged, missing, or incorrect type	• Replace valve stem oil deflectors
	• Valve stems or valve guides worn	• Measure stem-to-guide clearance and repair as necessary
	• Poorly fitted or missing valve cover baffles	• Replace valve cover
	• Piston rings broken or missing	• Replace broken or missing rings
	• Scuffed piston	• Replace piston
	• Incorrect piston ring gap	• Measure ring gap, repair as necessary
	• Piston rings sticking or excessively loose in grooves	• Measure ring side clearance, repair as necessary
	• Compression rings installed upside down	• Repair as necessary
	• Cylinder walls worn, scored, or glazed	• Repair as necessary

tccs3c02

Troubleshooting Engine Mechanical Problems

Problem	Cause	Solution
Excessive oil consumption (cont.)	• Piston ring gaps not properly staggered	• Repair as necessary
	• Excessive main or connecting rod bearing clearance	• Measure bearing clearance, repair as necessary
No oil pressure	• Low oil level	• Add oil to correct level
	• Oil pressure gauge, warning lamp or sending unit inaccurate	• Replace oil pressure gauge or warning lamp
	• Oil pump malfunction	• Replace oil pump
	• Oil pressure relief valve sticking	• Remove and inspect oil pressure relief valve assembly
	• Oil passages on pressure side of pump obstructed	• Inspect oil passages for obstruction
	• Oil pickup screen or tube obstructed	• Inspect oil pickup for obstruction
	• Loose oil inlet tube	• Tighten or seal inlet tube
Low oil pressure	• Low oil level	• Add oil to correct level
	• Inaccurate gauge, warning lamp or sending unit	• Replace oil pressure gauge or warning lamp
	• Oil excessively thin because of dilution, poor quality, or improper grade	• Drain and refill crankcase with recommended oil
	• Excessive oil temperature	• Correct cause of overheating engine
	• Oil pressure relief spring weak or sticking	• Remove and inspect oil pressure relief valve assembly
	• Oil inlet tube and screen assembly has restriction or air leak	• Remove and inspect oil inlet tube and screen assembly. (Fill inlet tube with lacquer thinner to locate leaks.)
	• Excessive oil pump clearance	• Measure clearances
	• Excessive main, rod, or camshaft bearing clearance	• Measure bearing clearances, repair as necessary
High oil pressure	• Improper oil viscosity	• Drain and refill crankcase with correct viscosity oil
	• Oil pressure gauge or sending unit inaccurate	• Replace oil pressure gauge
	• Oil pressure relief valve sticking closed	• Remove and inspect oil pressure relief valve assembly
Main bearing noise	• Insufficient oil supply	• Inspect for low oil level and low oil pressure
	• Main bearing clearance excessive	• Measure main bearing clearance, repair as necessary
	• Bearing insert missing	• Replace missing insert
	• Crankshaft end-play excessive	• Measure end-play, repair as necessary
	• Improperly tightened main bearing cap bolts	• Tighten bolts with specified torque
	• Loose flywheel or drive plate	• Tighten flywheel or drive plate attaching bolts
	• Loose or damaged vibration damper	• Repair as necessary

tccs3c03

Troubleshooting Engine Mechanical Problems

Problem	Cause	Solution
Connecting rod bearing noise	· Insufficient oil supply	· Inspect for low oil level and low oil pressure
	· Carbon build-up on piston	· Remove carbon from piston crown
	· Bearing clearance excessive or bearing missing	· Measure clearance, repair as necessary
	· Crankshaft connecting rod journal out-of-round	· Measure journal dimensions, repair or replace as necessary
	· Misaligned connecting rod or cap	· Repair as necessary
	· Connecting rod bolts tightened improperly	· Tighten bolts with specified torque
Piston noise	· Piston-to-cylinder wall clearance excessive (scuffed piston)	· Measure clearance and examine piston
	· Cylinder walls excessively tapered or out-of-round	· Measure cylinder wall dimensions, rebore cylinder
	· Piston ring broken	· Replace all rings on piston
	· Loose or seized piston pin	· Measure piston-to-pin clearance, repair as necessary
	· Connecting rods misaligned	· Measure rod alignment, straighten or replace
	· Piston ring side clearance excessively loose or tight	· Measure ring side clearance, repair as necessary
	· Carbon build-up on piston is excessive	· Remove carbon from piston
Valve actuating component noise	· Insufficient oil supply	· Check for: (a) Low oil level (b) Low oil pressure (c) Wrong hydraulic tappets (d) Restricted oil gallery (e) Excessive tappet to bore clearance
	· Rocker arms or pivots worn	· Replace worn rocker arms or pivots
	· Foreign objects or chips in hydraulic tappets	· Clean tappets
	· Excessive tappet leak-down	· Replace valve tappet
	· Tappet face worn	· Replace tappet; inspect corresponding cam lobe for wear
	· Broken or cocked valve springs	· Properly seat cocked springs; replace broken springs
	· Stem-to-guide clearance excessive	· Measure stem-to-guide clearance, repair as required
	· Valve bent	· Replace valve
	· Loose rocker arms	· Check and repair as necessary
	· Valve seat runout excessive	· Regrind valve seat/valves
	· Missing valve lock	· Install valve lock
	· Excessive engine oil	· Correct oil level

tccs3c04

Troubleshooting Engine Performance

Problem	Cause	Solution
Hard starting (engine cranks normally)	• Faulty engine control system component	• Repair or replace as necessary
	• Faulty fuel pump	• Replace fuel pump
	• Faulty fuel system component	• Repair or replace as necessary
	• Faulty ignition coil	• Test and replace as necessary
	• Improper spark plug gap	• Adjust gap
	• Incorrect ignition timing	• Adjust timing
	• Incorrect valve timing	• Check valve timing; repair as necessary
Rough idle or stalling	• Incorrect curb or fast idle speed	• Adjust curb or fast idle speed (If possible)
	• Incorrect ignition timing	• Adjust timing to specification
	• Improper feedback system operation	• Refer to Chapter 4
	• Faulty EGR valve operation	• Test EGR system and replace as necessary
	• Faulty PCV valve air flow	• Test PCV valve and replace as necessary
	• Faulty TAC vacuum motor or valve	• Repair as necessary
	• Air leak into manifold vacuum	• Inspect manifold vacuum connections and repair as necessary
	• Faulty distributor rotor or cap	• Replace rotor or cap (Distributor systems only)
	• Improperly seated valves	• Test cylinder compression, repair as necessary
	• Incorrect ignition wiring	• Inspect wiring and correct as necessary
	• Faulty ignition coil	• Test coil and replace as necessary
	• Restricted air vent or idle passages	• Clean passages
	• Restricted air cleaner	• Clean or replace air cleaner filter element
Faulty low-speed operation	• Restricted idle air vents and passages	• Clean air vents and passages
	• Restricted air cleaner	• Clean or replace air cleaner filter element
	• Faulty spark plugs	• Clean or replace spark plugs
	• Dirty, corroded, or loose ignition secondary circuit wire connections	• Clean or tighten secondary circuit wire connections
	• Improper feedback system operation	• Refer to Chapter 4
	• Faulty ignition coil high voltage wire	• Replace ignition coil high voltage wire (Distributor systems only)
	• Faulty distributor cap	• Replace cap (Distributor systems only)
Faulty acceleration	• Incorrect ignition timing	• Adjust timing
	• Faulty fuel system component	• Repair or replace as necessary
	• Faulty spark plug(s)	• Clean or replace spark plug(s)
	• Improperly seated valves	• Test cylinder compression, repair as necessary
	• Faulty ignition coil	• Test coil and replace as necessary

tccs3c05

Troubleshooting Engine Performance

Problem	Cause	Solution
Faulty acceleration (cont.)	• Improper feedback system operation	• Refer to Chapter 4
Faulty high speed operation	• Incorrect ignition timing	• Adjust timing (if possible)
	• Faulty advance mechanism	• Check advance mechanism and repair as necessary (Distributor systems only)
	• Low fuel pump volume	• Replace fuel pump
	• Wrong spark plug air gap or wrong plug	• Adjust air gap or install correct plug
	• Partially restricted exhaust manifold, exhaust pipe, catalytic converter, muffler, or tailpipe	• Eliminate restriction
	• Restricted vacuum passages	• Clean passages
	• Restricted air cleaner	• Cleaner or replace filter element as necessary
	• Faulty distributor rotor or cap	• Replace rotor or cap (Distributor systems only)
	• Faulty ignition coil	• Test coil and replace as necessary
	• Improperly seated valve(s)	• Test cylinder compression, repair as necessary
	• Faulty valve spring(s)	• Inspect and test valve spring tension, replace as necessary
	• Incorrect valve timing	• Check valve timing and repair as necessary
	• Intake manifold restricted	• Remove restriction or replace manifold
	• Worn distributor shaft	• Replace shaft (Distributor systems only)
	• Improper feedback system operation	• Refer to Chapter 4
Misfire at all speeds	• Faulty spark plug(s)	• Clean or relace spark plug(s)
	• Faulty spark plug wire(s)	• Replace as necessary
	• Faulty distributor cap or rotor	• Replace cap or rotor (Distributor systems only)
	• Faulty ignition coil	• Test coil and replace as necessary
	• Primary ignition circuit shorted or open intermittently	• Troubleshoot primary circuit and repair as necessary
	• Improperly seated valve(s)	• Test cylinder compression, repair as necessary
	• Faulty hydraulic tappet(s)	• Clean or replace tappet(s)
	• Improper feedback system operation	• Refer to Chapter 4
	• Faulty valve spring(s)	• Inspect and test valve spring tension, repair as necessary
	• Worn camshaft lobes	• Replace camshaft
	• Air leak into manifold	• Check manifold vacuum and repair as necessary
	• Fuel pump volume or pressure low	• Replace fuel pump
	• Blown cylinder head gasket	• Replace gasket
	• Intake or exhaust manifold passage(s) restricted	• Pass chain through passage(s) and repair as necessary
Power not up to normal	• Incorrect ignition timing	• Adjust timing
	• Faulty distributor rotor	• Replace rotor (Distributor systems only)

tccs3c06

Troubleshooting Engine Performance

Problem	Cause	Solution
Power not up to normal (cont.)	• Incorrect spark plug gap	• Adjust gap
	• Faulty fuel pump	• Replace fuel pump
	• Faulty fuel pump	• Replace fuel pump
	• Incorrect valve timing	• Check valve timing and repair as necessary
	• Faulty ignition coil	• Test coil and replace as necessary
	• Faulty ignition wires	• Test wires and replace as necessary
	• Improperly seated valves	• Test cylinder compression and repair as necessary
	• Blown cylinder head gasket	• Replace gasket
	• Leaking piston rings	• Test compression and repair as necessary
	• Improper feedback system operation	• Refer to Chapter 4
Intake backfire	• Improper ignition timing	• Adjust timing
	• Defective EGR component	• Repair as necessary
	• Defective TAC vacuum motor or valve	• Repair as necessary
Exhaust backfire	• Air leak into manifold vacuum	• Check manifold vacuum and repair as necessary
	• Faulty air injection diverter valve	• Test diverter valve and replace as necessary
	• Exhaust leak	• Locate and eliminate leak
Ping or spark knock	• Incorrect ignition timing	• Adjust timing
	• Distributor advance malfunction	• Inspect advance mechanism and repair as necessary (Distributor systems only)
	• Excessive combustion chamber deposits	• Remove with combustion chamber cleaner
	• Air leak into manifold vacuum	• Check manifold vacuum and repair as necessary
	• Excessively high compression	• Test compression and repair as necessary
	• Fuel octane rating excessively low	• Try alternate fuel source
	• Sharp edges in combustion chamber	• Grind smooth
	• EGR valve not functioning properly	• Test EGR system and replace as necessary
Surging (at cruising to top speeds)	• Low fuel pump pressure or volume	• Replace fuel pump
	• Improper PCV valve air flow	• Test PCV valve and replace as necessary
	• Air leak into manifold vacuum	• Check manifold vacuum and repair as necessary
	• Incorrect spark advance	• Test and replace as necessary
	• Restricted fuel filter	• Replace fuel filter
	• Restricted air cleaner	• Clean or replace air cleaner filter element
	• EGR valve not functioning properly	• Test EGR system and replace as necessary
	• Improper feedback system operation	• Refer to Chapter 4

tccs3c07

4

DRIVEABILITY AND EMISSION CONTROLS

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AIR POLLUTION

The earth's atmosphere, at or near sea level, consists approximately of 78 percent nitrogen, 21 percent oxygen and 1 percent other gases. If it were possible to remain in this state, 100 percent clean air would result. However, many varied sources allow other gases and particulates to mix with the clean air, causing our atmosphere to become unclean or polluted.

Certain of these pollutants are visible while others are invisible, with each having the capability of causing distress to the eyes, ears, throat, skin and respiratory system. Should these pollutants become concentrated in a specific area and under certain conditions, death could result due to the displacement or chemical change of the oxygen content in the air. These pollutants can also cause great damage to the environment and to the many man made objects that are exposed to the elements.

To better understand the causes of air pollution, the pollutants can be categorized into 3 separate types, natural, industrial and automotive.

Natural Pollutants

Natural pollution has been present on earth since before man appeared and continues to be a factor when discussing air pollution, although it causes only a small percentage of the overall pollution problem. It is the direct result of decaying organic matter, wind born smoke and particulates from such natural events as plain and forest fires (ignited by heat or lightning), volcanic ash, sand and dust which can spread over a large area of the countryside.

Such a phenomenon of natural pollution has been seen in the form of volcanic eruptions, with the resulting plume of smoke, steam and volcanic ash blotting out the sun's rays as it spreads and rises higher into the atmosphere. As it travels into the atmosphere the upper air currents catch and carry the smoke and ash, while condensing the steam back into water vapor. As the water vapor, smoke and ash travel on their journey, the smoke dissipates into the atmosphere while the ash and moisture settle back to earth in a trail hundreds of miles long. In some cases, lives are lost and millions of dollars of property damage result.

Industrial Pollutants

Industrial pollution is caused primarily by industrial processes, the burning of coal, oil and natural gas, which in turn produce smoke and fumes. Because the burning fuels contain large amounts of sulfur, the principal ingredients of smoke and fumes are sulfur dioxide and particulate matter. This type of pollutant occurs most severely during still, damp and cool weather, such as at night. Even in its less severe form, this pollutant is not confined to just cities. Because of air movements, the pollutants move for miles over the surrounding countryside, leaving in its path a barren and unhealthy environment for all living things.

Working with Federal, State and Local mandated regulations and by carefully monitoring emissions, big business has greatly reduced the amount of pollutant introduced from its industrial sources, striving to obtain an acceptable level. Because of the mandated industrial emission clean up, many land areas and streams in and around the cities that were formerly barren of vegetation and life, have now begun to move back in the direction of nature's intended balance.

Automotive Pollutants

The third major source of air pollution is automotive emissions. The emissions from the internal combustion engines were not an appreciable problem years ago because of the small number of registered vehicles and the nation's small highway system. However, during the early 1950's, the trend of the American people was to move from the cities to the surrounding suburbs. This caused an immediate problem in transportation because the majority of suburbs were not afforded mass transit conveniences. This lack of transportation created an attractive market for the automobile manufacturers, which resulted in a dramatic increase in the number of vehicles produced and sold, along with a marked increase in highway construction between cities and the suburbs. Multi-vehicle families emerged with a growing emphasis placed on an individual vehicle per family member. As the increase in vehicle ownership and usage occurred, so did pollutant levels in and around the cities, as suburbanites drove daily to their businesses and employment, returning at the end of the day to their homes in the suburbs.

It was noted that a smoke and fog type haze was being formed and at times, remained in suspension over the cities, taking time to dissipate. At first this "smog," derived from the words "smoke" and "fog," was thought to result from industrial pollution but it was determined that automobile emissions shared the blame. It was discovered that when normal automobile emissions were exposed to sunlight for a period of time, complex chemical reactions would take place.

It is now known that smog is a photo chemical layer which develops when certain oxides of nitrogen (NOx) and unburned hydrocarbons (HC) from automobile emissions are exposed to sunlight. Pollution was more severe when smog would become stagnant over an area in which a warm layer of air settled over the top of the cooler air mass, trapping and holding the cooler mass at ground level. The trapped cooler air would keep the emissions from being dispersed and diluted through normal air flows. This type of air stagnation was given the name "Temperature Inversion."

TEMPERATURE INVERSION

In normal weather situations, surface air is warmed by heat radiating from the earth's surface and the sun's rays. This causes it to rise upward, into the atmosphere. Upon rising it will cool through a convection type heat exchange with the cooler upper air. As warm air rises, the surface pollutants are carried upward and dissipated into the atmosphere.

When a temperature inversion occurs, we find the higher air is no longer cooler, but is warmer than the surface air, causing the cooler surface air to become trapped. This warm air blanket can extend from above ground level to a few hundred or even a few thousand feet into the air. As the surface air is trapped, so are the pollutants, causing a severe smog condition. Should this stagnant air mass extend to a few thousand feet high, enough air movement with the inversion takes place to allow the smog layer to rise above ground level but the pollutants still cannot dissipate. This inversion can remain for days over an area, with the smog level only rising or lowering from ground level to a few hundred feet high. Meanwhile, the pollutant levels increase, causing eye irritation, respiratory problems, reduced visibility, plant damage and in some cases, even disease.

This inversion phenomenon was first noted in the Los Angeles, California area. The city lies in terrain resembling a basin and with certain weather conditions, a cold air mass is held in the basin while a warmer air mass covers it like a lid.

Because this type of condition was first documented as prevalent in the Los Angeles area, this type of trapped pollution was named Los Angeles Smog, although it occurs in other areas where a large concentration of automobiles are used and the air remains stagnant for any length of time.

HEAT TRANSFER

Consider the internal combustion engine as a machine in which raw materials must be placed so a finished product comes out. As in any machine operation, a certain amount of wasted material is formed. When we relate this to the internal combustion engine, we find that through the input of air and fuel, we obtain power during the combustion process to drive the vehicle. The by-product or waste of this power is, in part, heat and exhaust gases with which we must dispose.

The heat from the combustion process can rise to over 4000°F (2204°C). The dissipation of this heat is controlled by a ram air effect, the use of cooling fans to cause air flow and a liquid coolant solution surrounding the combustion area to transfer the heat of combustion through the cylinder walls and into the coolant. The coolant is then directed to a thin-finned, multi-tubed radiator, from which the excess heat is transferred to the atmosphere by 1 of the 3 heat transfer methods, conduction, convection or radiation.

The cooling of the combustion area is an important part in the control of exhaust emissions. To understand the behavior of the combustion and transfer of its heat, consider the air/fuel charge. It is ignited and the flame front burns progressively across the combustion chamber until the burning charge reaches the cylinder walls. Some of the fuel in contact with the walls is not hot enough to burn, thereby snuffing out or quenching the combustion process. This leaves unburned fuel in the combustion chamber. This unburned fuel is then forced out of the cylinder and into the exhaust system, along with the exhaust gases.

Many attempts have been made to minimize the amount of unburned fuel in the combustion chambers due to quenching, by increasing the coolant temperature and lessening the contact area of the coolant around the combustion area. However, design limitations within the combustion chambers prevent the complete burning of the air/fuel charge, so a certain amount of the unburned fuel is still expelled into the exhaust system, regardless of modifications to the engine.

AUTOMOTIVE EMISSIONS

Before emission controls were mandated on internal combustion engines, other sources of engine pollutants were discovered along with the exhaust emissions. It was determined that engine combustion exhaust produced approximately 60 percent of the total emission pollutants, fuel evaporation from the fuel tank and carburetor vents produced 20 percent, with the final 20 percent being produced through the crankcase as a by-product of the combustion process.

Exhaust Gases

The exhaust gases emitted into the atmosphere are a combination of burned and unburned fuel. To understand the exhaust emission and its composition, we must review some basic chemistry.

When the air/fuel mixture is introduced into the engine, we are mixing air, composed of nitrogen (78 percent), oxygen (21 percent) and other gases (1 percent) with the fuel, which is 100 percent hydrocarbons (HC), in a semi-controlled ratio. As the combustion process is accomplished, power is produced to move the vehicle while the heat of combustion is transferred to the cooling system. The exhaust gases are then composed of nitrogen, a diatomic gas (N_2), the same as was introduced in the engine, carbon dioxide (CO_2), the same gas that is used in beverage carbonation, and water vapor (H_2O). The nitrogen (N_2), for the most part, passes through the engine unchanged, while the oxygen (O_2) reacts (burns) with the hydrocarbons (HC) and produces the carbon dioxide (CO_2) and the water vapors (H_2O). If this chemical process would be the only process to take place, the exhaust emissions would be harmless. However, during the combustion process, other compounds are formed which are considered dangerous. These pollutants are hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx) oxides of sulfur (SOx) and engine particulates.

HYDROCARBONS

Hydrocarbons (HC) are essentially fuel which was not burned during the combustion process or which has escaped into the atmosphere through fuel evaporation. The main sources of incomplete combustion are rich air/fuel mixtures, low engine temperatures and improper spark timing. The main sources of hydrocarbon emission through fuel evaporation on most vehicles used to be the vehicle's fuel tank and carburetor float bowl.

To reduce combustion hydrocarbon emission, engine modifications were made to minimize dead space and surface area in the combustion chamber. In addition, the air/fuel mixture was made more lean through the improved control which feedback carburetion and fuel injection offers and by the addition of external controls to aid in further combustion of the hydrocarbons outside the engine. Two such methods were the addition of air injection systems, to inject fresh air into the exhaust manifolds and the installation of catalytic converters, units that are able to burn traces of hydrocarbons without affecting the internal combustion process or fuel economy.

To control hydrocarbon emissions through fuel evaporation, modifications were made to the fuel tank to allow storage of the fuel vapors during periods of engine shut-down. Modifications were also made to the air intake system so that at specific times during engine operation, these vapors may be purged and burned by blending them with the air/fuel mixture.

CARBON MONOXIDE

Carbon monoxide is formed when not enough oxygen is present during the combustion process to convert carbon (C) to carbon dioxide (CO_2). An increase in the carbon monoxide (CO) emission is normally accompanied by an increase in the hydrocarbon (HC) emission because of the lack of oxygen to completely burn all of the fuel mixture.

Carbon monoxide (CO) also increases the rate at which the photo chemical smog is formed by speeding up the conversion of nitric oxide (NO) to nitrogen dioxide (NO_2). To accomplish this, carbon monoxide (CO) combines with oxygen (O_2) and nitric oxide (NO) to produce carbon dioxide (CO_2) and nitrogen dioxide (NO_2). ($CO + O_2 + NO = CO_2 + NO_2$).

The dangers of carbon monoxide, which is an odorless and colorless toxic gas are many. When carbon monoxide is inhaled into the lungs and passed into the blood stream, oxygen is replaced by the carbon monoxide in the red blood cells, causing a reduction in the amount of oxygen supplied to the many parts of the body. This lack of oxygen causes headaches, lack of coordination, reduced mental alertness and, should the carbon monoxide concentration be high enough, death could result.

NITROGEN

Normally, nitrogen is an inert gas. When heated to approximately 2500°F (1371°C) through the combustion process, this gas becomes active and causes an increase in the nitric oxide (NO) emission.

Oxides of nitrogen (NOx) are composed of approximately 97-98 percent nitric oxide (NO). Nitric oxide is a colorless gas but when it is passed into the atmosphere, it combines with oxygen and forms nitrogen dioxide (NO_2). The nitrogen dioxide then combines with chemically active hydrocarbons (HC) and when in the presence of sunlight, causes the formation of photo-chemical smog.

Ozone

To further complicate matters, some of the nitrogen dioxide (NO_2) is broken apart by the sunlight to form nitric oxide and oxygen. (NO_2 + sunlight = NO + O). This single atom of oxygen then combines with diatomic (meaning 2 atoms) oxygen (O_2) to form ozone (O_3). Ozone is one of the smells associated with smog. It has a pungent and offensive odor, irritates the eyes and lung tissues, affects the growth of plant life and causes rapid deterioration of rubber products. Ozone can be formed by sunlight as well as electrical discharge into the air.

The most common discharge area on the automobile engine is the secondary ignition electrical system, especially when inferior quality spark plug cables are used. As the surge of high voltage is routed through the secondary cable, the circuit builds up an electrical field around the wire, which acts upon the oxygen in the surrounding air to form the ozone. The faint glow along the cable with the engine running that may be visible on a dark night, is called the "corona discharge." It is the result of the electrical field passing from a high along the cable, to a low in the surrounding air, which forms the ozone gas. The combination of corona and ozone has been a major cause of cable deterioration. Recently, different and better quality insulating materials have lengthened the life of the electrical cables.

Although ozone at ground level can be harmful, ozone is beneficial to the earth's inhabitants. By having a concentrated ozone layer called the "ozonosphere," between 10 and 20 miles (16-32 km) up in the atmosphere, much of the ultra violet radiation from the sun's rays are absorbed and screened. If this ozone layer were not present, much of the earth's surface would be burned, dried and unfit for human life.

OXIDES OF SULFUR

Oxides of sulfur (SOx) were initially ignored in the exhaust system emissions, since the sulfur content of gasoline as a fuel is less than $^1/_{10}$ of 1 percent. Because of this small amount, it was felt that it contributed very little to the overall pollution problem. However, because of the difficulty in solving the sulfur emissions in industrial pollutions and the introduction of catalytic converter to the automobile exhaust systems, a change was mandated. The automobile exhaust system, when equipped with a catalytic converter, changes the sulfur dioxide (SO_2) into the sulfur trioxide (SO_3).

When this combines with water vapors (H_2O), a sulfuric acid mist (H_2SO_4) is formed and is a very difficult pollutant to handle since it is extremely corrosive. This sulfuric acid mist that is formed, is the same mist that rises from the vents of an automobile battery when an active chemical reaction takes place within the battery cells.

When a large concentration of vehicles equipped with catalytic converters are operating in an area, this acid mist may rise and be distributed over a large ground area causing land, plant, crop, paint and building damage.

PARTICULATE MATTER

A certain amount of particulate matter is present in the burning of any fuel, with carbon constituting the largest percentage of the particulates. In gasoline, the remaining particulates are the burned remains of the various other compounds used in its manufacture. When a gasoline engine is in good internal condition, the particulate emissions are low but as the engine wears internally, the particulate emissions increase. By visually inspecting the tail pipe emissions, a determination can be made as to where an engine defect may exist. An engine with light gray or blue smoke emitting from the tail pipe normally indicates an increase in the oil consumption through burning due to internal engine wear. Black smoke would indicate a defective fuel delivery system, causing the engine to operate in a rich mode. Regardless of the color of the smoke, the internal part of the engine or the fuel delivery system should be repaired to prevent excess particulate emissions.

Diesel and turbine engines emit a darkened plume of smoke from the exhaust system because of the type of fuel used. Emission control regulations are mandated for this type of emission and more stringent measures are being used to prevent excess emission of the particulate matter. Electronic components are being introduced to control the injection of the fuel at precisely the proper time of piston travel, to achieve the optimum in fuel ignition and fuel usage. Other particulate after-burning components are being tested to achieve a cleaner emission.

Good grades of engine lubricating oils should be used, which meet the manufacturers specification. Cut-rate oils can contribute to the particulate emission problem because of their low flash or ignition temperature point. Such oils burn prematurely during the combustion process causing emission of particulate matter.

The cooling system is an important factor in the reduction of particulate matter. The optimum combustion will occur, with the cooling system operating at a temperature specified by the manufacturer. The cooling system must be maintained in the same manner as the engine oiling system, as each system is required to perform properly in order for the engine to operate efficiently for a long time.

Crankcase Emissions

Crankcase emissions are made up of water, acids, unburned fuel, oil fumes and particulates. These emissions are classified as hydrocarbons (HC) and are formed by the small amount of unburned, compressed air/fuel mixture entering the crankcase from the combustion area (between the cylinder walls and piston rings) during the compression and power strokes. The head of the compression and combustion help to form the remaining crankcase emissions.

Since the first engines, crankcase emissions were allowed into the atmosphere through a road draft tube, mounted on the lower side of the engine block. Fresh air came in through an open oil filler cap or breather. The air passed through the crankcase mixing with blow-by gases. The motion of the vehicle and the air blowing past the open end of the road draft tube caused a low pressure area (vacuum) at the end of the tube. Crankcase emissions were simply drawn out of the road draft tube into the air.

To control the crankcase emission, the road draft tube was deleted. A hose and/or tubing was routed from the crankcase to the intake manifold so the blow-by emission could be burned with the air/fuel mixture. However, it was found that intake manifold vacuum, used to draw the crankcase emissions into the manifold, would vary in strength at the wrong time and not allow the proper emission flow. A regulating valve was needed to control the flow of air through the crankcase.

Testing, showed the removal of the blow-by gases from the crankcase as quickly as possible, was most important to the longevity of the engine. Should large accumulations of blow-by gases remain and condense, dilution of the engine oil would occur to form water, soots, resins, acids and lead salts, resulting in the formation of sludge and varnishes. This condensation of the blow-by gases occurs more frequently on vehicles used in numerous starting and stopping conditions, excessive idling and when the engine is not allowed to attain normal operating temperature through short runs.

Evaporative Emissions

Gasoline fuel is a major source of pollution, before and after it is burned in the automobile engine. From the time the fuel is refined, stored, pumped and transported, again stored until it is pumped into the fuel tank of the vehicle, the gasoline gives off unburned hydrocarbons (HC) into the atmosphere. Through the redesign of storage areas and venting systems, the pollution factor was diminished, but not eliminated, from the refinery standpoint. However, the automobile still remained the primary source of vaporized, unburned hydrocarbon (HC) emissions.

Fuel pumped from an underground storage tank is cool but when exposed to a warmer ambient temperature, will expand. Before controls were mandated, an owner might fill the fuel tank with fuel from an underground storage tank and park the vehicle for some time in warm area, such as a parking lot. As the fuel would warm, it would expand and should no provisions or area be provided for the expansion, the fuel would spill out of the filler neck and onto the ground, causing hydrocarbon (HC) pollution and creating a severe fire hazard. To correct this condition, the vehicle manufacturers added overflow plumbing and/or gasoline tanks with built in expansion areas or domes.

However, this did not control the fuel vapor emission from the fuel tank. It was determined that most of the fuel evaporation occurred when the vehicle was stationary and the engine not operating. Most vehicles carry 5-25 gallons (19-95 liters) of gasoline. Should a large concentration of vehicles be parked in one area, such as a large parking lot, excessive fuel vapor emissions would take place, increasing as the temperature increases.

To prevent the vapor emission from escaping into the atmosphere, the fuel systems were designed to trap the vapors while the vehicle is stationary, by sealing the system from the atmosphere. A storage system is used to collect and hold the fuel vapors from the carburetor (if equipped) and the fuel tank when the engine is not operating. When the engine is started, the storage system is then purged of the fuel vapors, which are drawn into the engine and burned with the air/fuel mixture.

EMISSION CONTROLS

Crankcase Ventilation System

OPERATION

➧ **See Figures 1, 2, 3, 4 and 5**

A closed, positive crankcase ventilation system is employed on all Toyota trucks. This system cycles incompletely burned fuel (which works its way past the piston rings) back into the intake manifold for reburning with the air/fuel mixture. The oil filler cap is sealed; and the air is drawn from the top of the crankcase into the intake manifold through a valve with a variable orifice.

The recirculation system relies on the integrity of the engine seals. Any air leak around the valve cover, head gasket, oil pan, dipstick, oil filler cap, air intake ducts, vacuum or breather hoses can introduce excess air into the fuel/air mixture, causing rough running or reduced efficiency. Likewise, a plugged hose or passage can cause sludging, stalling and oil leaks.

COMPONENT TESTING

Inspect the PCV system hoses and connections at each tune-up and replace any deteriorated hoses. Check the PCV valve at every tune-up and replace it at 30,000 mile (48,000 km) intervals.

The PCV valve is easily checked with the engine running at normal idle speed (warmed up).

1. Remove the PCV valve from the valve cover or intake manifold, but leave it connected to its hose.
2. Start the engine.
3. Place your thumb over the end of the valve to check for vacuum. If there is no vacuum, check for plugged hoses or ports. If these are open, the valve is faulty.
4. With the engine **OFF**, remove the valve completely. Shake it end-to-end, listening for the rattle of the needle inside the valve. If no rattle is heard, the needle is jammed (probably due to oil sludge) and the valve should be replaced.

⁂CAUTION

Don't blow directly into the valve; petroleum deposits within the valve can be harmful.

An engine without crankcase ventilation is quickly damaged. It is important to check the PCV at regular intervals. When replacing a PCV valve you must use the correct one for the engine. Many valves look alike on the outside, but have different mechanical values. Putting the incorrect valve on a vehicle can cause a great deal of driveability problems. The engine computer assumes the valve is the correct one and may over adjust the ignition timing or fuel mixture.

REMOVAL & INSTALLATION

1. Pull the PCV valve from the valve cover or the intake manifold.
2. Remove the hose from the valve.
3. Check the valve for proper operation.
4. Inspect the rubber grommet the PCV valve fits into. If it is in any way deteriorated or oil soaked, replace it.

To install:

5. Insert a new valve into the hose.
6. Push the valve into the rubber grommet. Make sure the valve is firmly into place.

Evaporative Emission Controls

OPERATION

The evaporative emission control system prevents the release of unburned hydrocarbons from the liquid gasoline vapor into the atmosphere. Evaporative fuel vapor from the tank is routed to the charcoal canister located in the engine compartment. The charcoal canister stores the vapor until the engine coolant temperature reaches 129°F (54°C). When the engine coolant temperature is above 129°F (54°C) and the throttle is open, a vacuum switching valve opens to allow vapors trapped in the canister to enter the intake manifold.

A fuel filler cap with a check valve allows air to enter the fuel tank as the fuel is used. This prevents a vacuum build-up in the fuel tank as the engine is running.

COMPONENT TESTING

Charcoal Canister

EXCLUDING 3RZ-FE

➧ **See Figures 6 and 7**

1. Label and disconnect the vacuum hose at the top of the canister. Remove the charcoal canister from the vehicle.
2. Remove the vacuum switching valve.
3. Look for cracks or damage to the outside of the canister.
4. Using a low pressure of compressed air 0.68 psi (5 kPa), blow into the tank pipe and check that air flows without any resistance from the other pipes.
5. Blow air into the purge pipe and check that air does not flow from the tank pipe and air flows without resistance from the other pipe. If there is any problems found, replace the canister.
6. Clean the filter in the canister by blowing 43 psi (296 kPa) of compressed air into the canister tank pipe while holding the other upper canister tank pipe closed.

➡Do not attempt to wash the canister. No activated carbon should come out of the canister while cleaning or inspecting the unit. If it does, replace the canister.

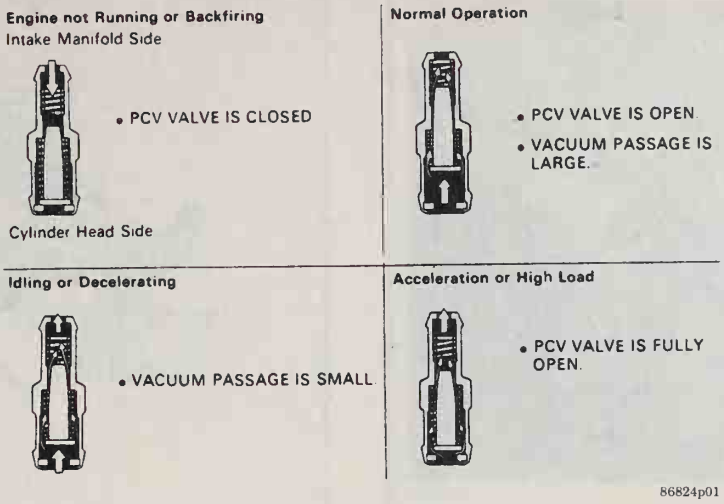

Engine not Running or Backfiring
Intake Manifold Side
• PCV VALVE IS CLOSED
Cylinder Head Side
Normal Operation
• PCV VALVE IS OPEN.
• VACUUM PASSAGE IS LARGE.
Idling or Decelerating
• VACUUM PASSAGE IS SMALL.
Acceleration or High Load
• PCV VALVE IS FULLY OPEN.
86824p01

Fig. 1 The PCV valve functions differently according to engine operating conditions

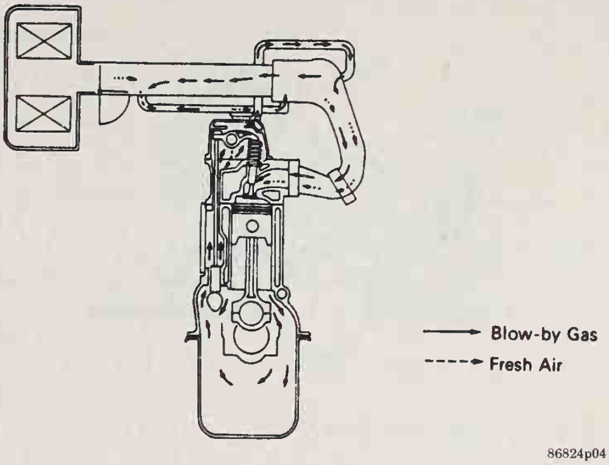

Blow-by Gas
Fresh Air
86824p04

Fig. 2 PCV system flow — 3F-E engine

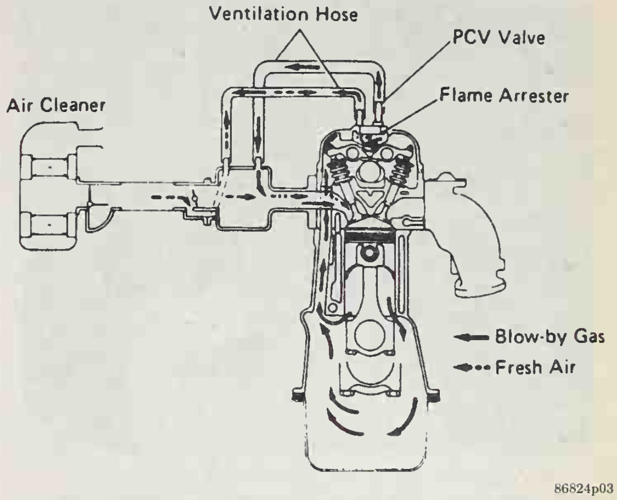

Ventilation Hose
PCV Valve
Air Cleaner
Flame Arrester
Blow-by Gas
Fresh Air
86824p03

Fig. 4 PCV system flow — 22R-E engine

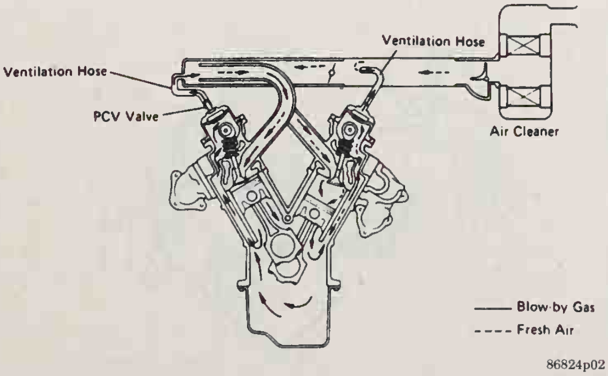

Ventilation Hose
Ventilation Hose
PCV Valve
Air Cleaner
Blow-by Gas
Fresh Air
86824p02

Fig. 3 PCV system flow — 3VZ-FE engine

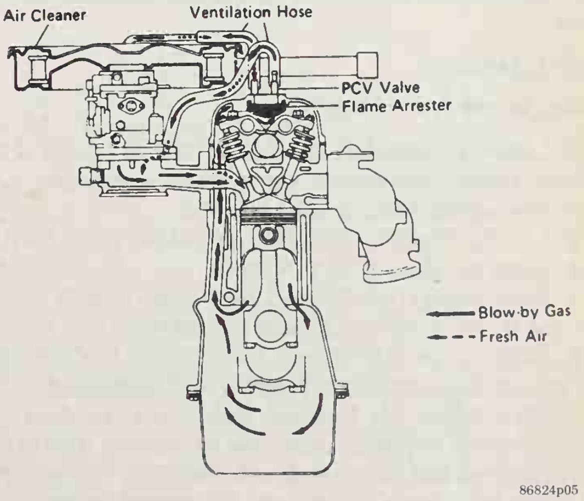

Air Cleaner
Ventilation Hose
PCV Valve
Flame Arrester
Blow-by Gas
Fresh Air
86824p05

Fig. 5 PCV system flow — 22R engine

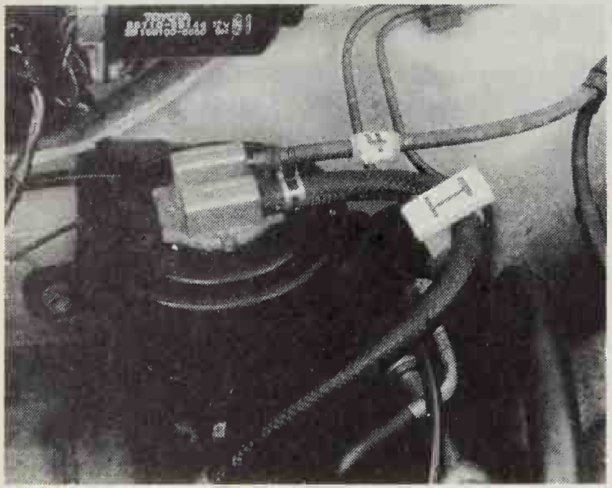

86824p20

Fig. 6 Always label hoses and wires prior to removal

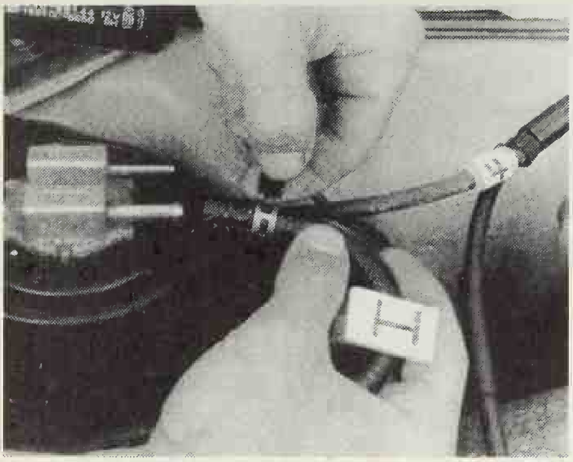

86824p21

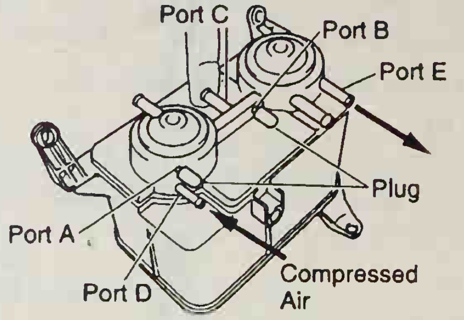
Fig. 7 The hoses are easily removed by sliding the clamp off the port end

7. Install the canister on the vehicle and reconnect the hoses.

3RZ-FE ENGINE

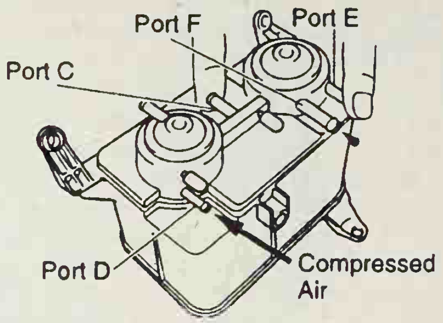
➧ See Figures 8, 9, 10 and 11

1. Label and disconnect the vacuum hose at the top of the canister. Remove the charcoal canister from the vehicle.
2. Remove the vacuum switching valve.
3. Look for cracks or damage to the outside of the canister.
4. Install the plugs to ports **A** and **B**.
5. While holding port **C** closed, blow air 0.21 psi (2 kPa) into port **D** and check that air does not flow from port **F**.
6. Apply vacuum 0.87 in. Hg (3 kPa) to port **C**, check that the vacuum does not decrease when port **F** is released.
7. While holding port **F** closed, apply 0.87 in. Hg (2.94 kPa) of vacuum to port **D**. Check that the vacuum does not decrease when port **C** is closed, and check that the vacuum decreases when port **C** is released. If a problem occurs, replace the charcoal canister.
8. Remove the plugs.



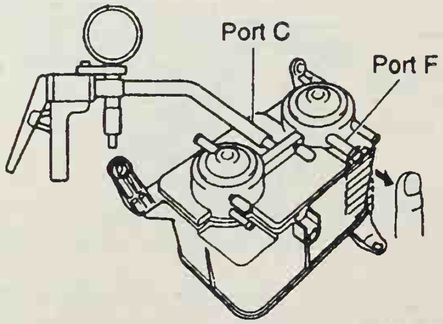
86824p16

Fig. 8 Location of the ports and plugs



86824p17

Fig. 9 Blow air into port D and check that air does not flow from port F



86824p18

Fig. 10 Apply vacuum to port C

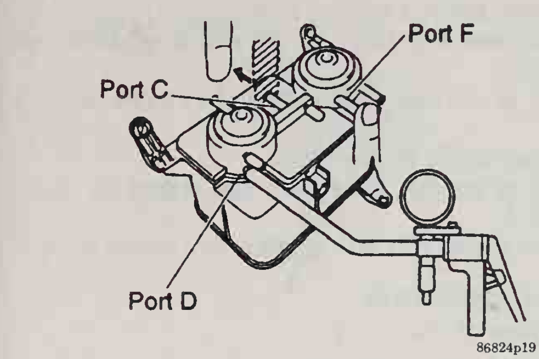


Fig. 11 Your finger can be used to plug port C

9. Reinstall the canister.

Thermal Vacuum Valve (TVV)

1FZ-FE ENGINE

See Figures 12 and 13

1. Disconnect the negative battery cable.
2. Drain the engine coolant from the radiator.
3. Remove the TVV from the engine cylinder head.
4. Check that air blown into pipe **J** exits out the air filter on the top of the valve. This is a closed valve reaction.
5. Heat the TVV in water to a temperature above 147°F (64°C).
6. Check that air blown into pipe **J** exits out pipe **K** of the valve.
7. If the TVV operation differs from specifications, replace the valve.

3VZ-E ENGINE

1. Disconnect the negative battery cable.
2. Drain the engine coolant from the radiator.
3. Remove the TVV from the engine intake manifold.
4. Blow air into the pipe and check that the valve is closed.
5. Heat the TVV in water to above 129°F (54°C).
6. Blow air into the pipe and check that the TVV is open.
7. If the TVV operation differs from specifications, replace the valve.

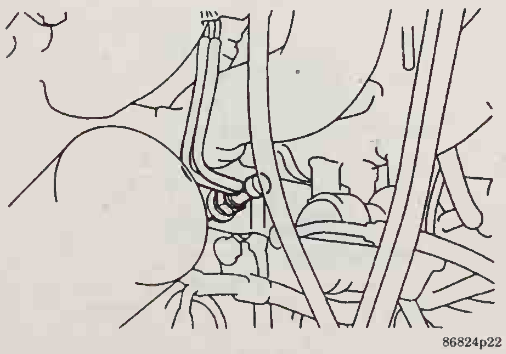


Fig. 12 The TVV is located near the oil filter as shown here

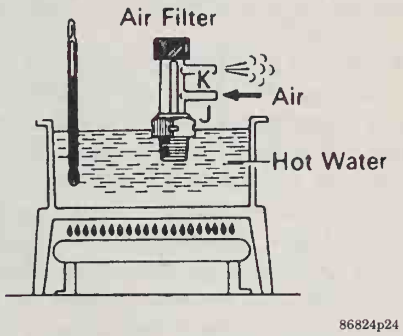


Fig. 13 Heat the valve in hot water

Vacuum Switching Valve (VSV)

22R ENGINE

See Figure 14

1. Disconnect the VSV electrical wiring.
2. Connect the VSV terminals to the battery terminals using jumper wires.
3. Blow into the pipe and check that the valve is open.
4. Disconnect the positive battery terminal jumper wire.
5. Blow into the valve and check that the valve is closed.
6. If the valve is not operating properly, replace it.

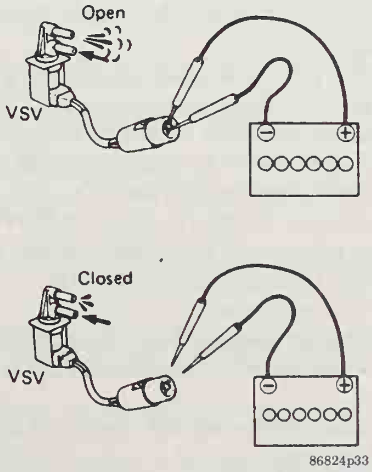


Fig. 14 The 22R VCV should only open when power is applied

T100 WITH 3VZ-E ENGINE

1. Disconnect the negative battery cable. Remove the VSV from the engine.
2. Connect the VSV terminals to the battery using jumper wires.
3. Blow air into pipe **E** and check that air comes out of pipe **F**. Disconnect the battery from the VSV.
4. Blow air into pipe **E** and check that air does not come out of pipe **F**. If a problem exists, replace the VSV.
5. Check the VSV for short circuit using an ohmmeter. Check that there is no continuity between the terminals and the body of the VSV. If continuity exists, replace the VSV.
6. Check the VSV for an open circuit. Using an ohmmeter, measure the resistance between the terminals. Compare the measured resistance to the desired range of 30-50 ohms at 68°F (20°C). If the resistance is not within specification, replace the VSV.

2RZ-FE AND 3RZ-FE ENGINES

1. Remove the VSV, by disconnecting the harness and the EVAP hoses from the unit.
2. On the 3RZ-FE, remove the 2 bolts and screw from the unit.
3. Inspect the VSV for an open circuit as follows:
    a. Using an ohmmeter, check that there is continuity between the terminals. The resistance should be 30-34 ohms at 68°F (20°C).
4. Check for ground as follows:
    a. Using an ohmmeter, check that there is no continuity between each terminal and the body. If there is continuity, replace the VSV.
5. Check the operation of the VSV as follows:
    a. Ensure that air does not flow from ports **E** to **F**. Never apply more than 13.5 psi (93 kPa) of compressed air to the VSV valve.
    b. Connect the battery to the terminals using jumper wires. Check that the air flows from ports **E** to **F**. If not, replace the VSV.
6. Reinstall the VSV.

1FZ-FE ENGINE

1. Disconnect the negative battery cable. Remove the VSV from the engine.
2. Inspect the VSV for an open circuit using an ohmmeter. Check that there is continuity between terminals on the VSV. Compare measured resistance to desired range of 30-33 ohms at 68°F (20°C). If no continuity or the measured resistance differs from specifications, replace the VSV.
3. Inspect the VSV for ground. Using an ohmmeter, check that there is no continuity between each terminal and the VSV body. If continuity is present, replace the VSV.
4. Inspect VSV operation:
    a. Check that air does not flow from pipe **E** to pipe **F**.
    b. Connect the battery to the terminals using jumper wires.
    c. With battery voltage applied, check that air does pass from pipe **E** to pipe **F**.
5. If test results differ from specifications, replace the VSV.

Vacuum Control Valve (VCV)

➧ See Figures 15 and 16

1. Remove the VCV from the engine.
2. Apply more then 2.8 in. Hg (9.3 kPa) of vacuum to pipe **S** of the VCV.
3. Blow air into pipe **Y** and check that air comes out of pipe **Z**.
4. Disconnect the vacuum source.
5. Blow air into pipe **Y** and check that air does not come out of pipe **Z**.
6. If test results differ from specifications, replace the VCV.

Outer Vent Control Valve

➧ See Figures 17, 18 and 19

➡This applies only to the 22R engine.

1. Disconnect the outer vent hose from the carburetor.
2. Blow air into the outer vent pipe and check that the vent control valve is open.

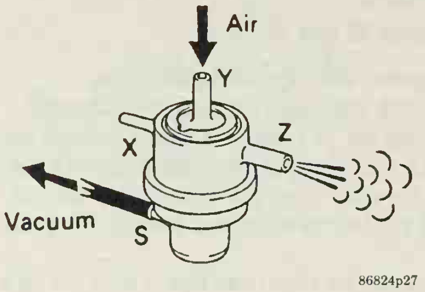


Fig. 15 When you blow air into port Y with vacuum applied, air should flow

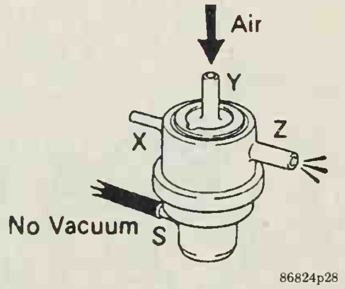


Fig. 16 Air should not flow when you blow air into port Y with vacuum disconnected

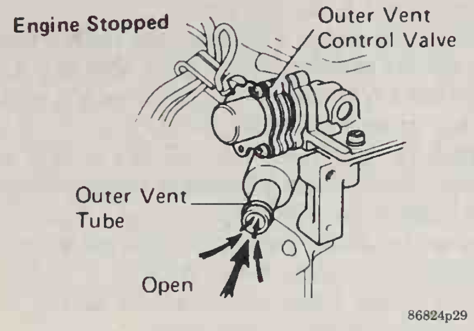


Fig. 17 While the engine is not running, blow air into the outer vent pipe to ensure the valve is open

3. Start the engine.
4. While idling, blow air into the outer vent pipe and check that the outer vent control valve is closed.
5. Unplug the solenoid wiring connector.
6. Using an ohmmeter, measure the resistance between the positive (+) terminal and the solenoid body. Resistance should be 63-73 ohms at 68°F (20°C).

REMOVAL & INSTALLATION

Thermal Vacuum Valve (TVV)

➧ See Figure 20

1. Disconnect the negative battery cable.
2. Drain the engine coolant to a level below the valve.
3. Label and disconnect the vacuum hoses from the TVV.
4. Remove the TVV from the engine.

To install:

5. Apply sealant to the lower 2 or 3 threads of the TVV.

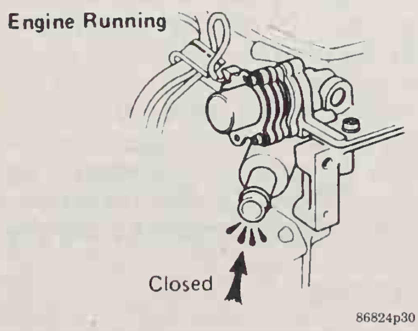


Fig. 18 While the engine is running, blow air into the outer vent pipe to ensure the valve is closed

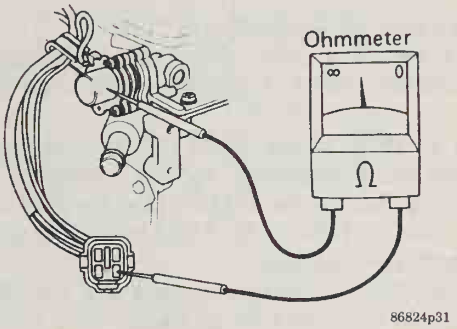


Fig. 19 Check the resistance with an ohmmeter

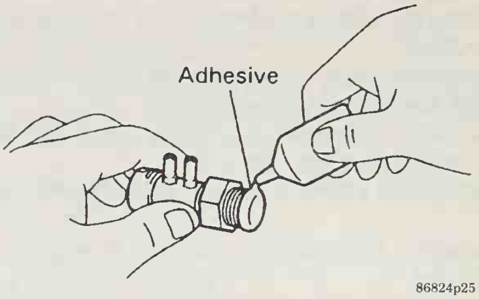


Fig. 20 Apply adhesive sealant to the threads before installing it

6. Thread the TVV into the engine. If equipped with 3VZ-E engine, tighten the TVV to 18 ft. lbs. (25 Nm). On 1FZ-FE engine, tighten TVV to 22 ft. lbs. (29 Nm).
7. Reconnect the vacuum hoses at their original locations an the cooling system.
8. Connect the negative battery cable.

Vacuum Switching Valve (VSV)

EXCLUDING 1FZ-FE

1. Disconnect the negative battery cable. Drain the engine coolant.
2. Label and remove the vacuum lines.
3. Using an appropriate sized wrench, remove the valve.

To install:

4. Check the vacuum hoses for deterioration or damage. Replace as necessary.
5. Coat the lower threads of the valve with sealant, and install the valve.
6. Install the vacuum hoses in their original locations.

7. Fill the cooling system and check for leaks.
8. Connect the negative battery cable.

1FZ-FE ENGINE

1. Disconnect the negative battery cable.
2. Drain the engine coolant. Disconnect the cruise control cable, accelerator cable and the throttle cable at the throttle body.
3. Disconnect the vacuum hoses and the EGR gas temperature sensor connector at the EGR valve. Loosen the EGR pipe union nut. Remove the 2 nuts holding the EGR valve and air intake chamber. Remove the 2 stud bolts, EGR valve and vacuum modulator assembly.
4. Remove the bolt holding the heater pipe and the air intake chamber. Disconnect the air cleaner hose, if still attached.
5. Label and disconnect the PCV hoses. Label and disconnect the remaining vacuum hoses. Disconnect the brake booster hose.
6. Disconnect the water bypass hose and the EVAP hose. Disconnect the connector from the emission control valve set assembly, throttle position sensor and the Idle Air Control (IAC) valve.
7. Remove the power steering reservoir tank mounting bolts and position tank aside. Disconnecting the fluid lines should not be necessary.
8. Remove the engine oil dipstick and guide. Remove the O-ring from the end of the dipstick guide.
9. Disconnect the engine ground strap. Label and disconnect the vacuum lines from the TVV.
10. Remove the 4 bolts, 4 nuts, air intake chamber and 2 gaskets.
11. Disconnect the air hose and vacuum from the the air intake chamber.
12. Remove the 4 mounting bolt and the emission control valve set assembly.
13. Unplug the connector and the 2 vacuum hoses. Remove the screw and VSV.

To install:

14. Install the VSV with the mounting screws.
15. Connect the 2 vacuum hoses and the harness connector to the VSV.
16. Install the emission control valve set with the 4 mounting bolts and tighten to 14 ft. lbs. (20 Nm).
17. Connect the air hoses and the vacuum hoses to the air intake chamber.
18. Clean the old gasket material from all mating surfaces. Install 2 new gaskets and the air intake chamber with the 4 mounting nuts and 4 bolts. Tighten fasteners to 14 ft. lbs. (21 Nm).
19. Connect the heater bypass hoses. Connect the 2 vacuum hoses to the TVV, then attach the engine ground strap.
20. Install new O-ring to the bottom of the oil dipstick guide and lubricate lightly with clean engine oil. Install the guide into the hole in the oil pan and tighten the retainer bolts to 14 ft. lbs. (20 Nm).
21. Install the power steering reservoir in position and secure in place. Tighten the mounting bolts to 13 ft. lbs. (18 Nm).
22. Connect the harness connectors to the emission control valve set assembly, throttle position sensor and IAC valve.
23. Engage the vacuum hoses and the water bypass hoses. Install the air cleaner hose.
24. Install the bolt holding the heater inlet and intake chamber, tightening to 14 ft. lbs. (20 Nm).
25. Install a new gasket, EGR valve and vacuum modulator assembly with the mounting bolts. Tighten bolts to 8 ft. lbs. (10 Nm). Install the 2 nuts holding the EGR valve and air intake chamber and tighten to 14 ft. lbs. (19 Nm).
26. Tighten the union nut of the EGR pipe to 47 ft. lbs. (64 Nm). Connect the EGR gas temperature sensor connector and 3 vacuum hoses to the EGR valve.
27. Connect the throttle cable, accelerator cable and cruise control actuator cable to the throttle body.
28. Fill the cooling system and inspect for leaks.
29. Connect the negative battery cable.

Vacuum Control Valve (VCV)

1. Disconnect the negative battery cable.
2. Label and disconnect the lines at the VCV. Inspect lines for deterioration and replace as required.
3. Remove the VCV from the engine.
4. Installation is the reverse of the removal procedure.

Exhaust Gas Recirculation (EGR) System

OPERATION

Oxides of nitrogen can be formed under conditions of high pressure and very high temperature. Reduction of one of these conditions reduces the production of NOx. A reduction of peak combustion temperature is accomplished by recirculating a small amount of exhaust gases into the combustion chamber.

This metering of exhaust gasses must be carefully monitored. Too much at the wrong time causes extremely poor driveability; too little and the emissions can increase dramatically. EGR function is overseen by an EGR modulator which controls the flow of vacuum (and therefore the flow of exhaust gasses), limiting it to times when the presence of exhaust gas will not adversely effect the running of the engine. The 22R and 22R-E use a Bimetal Vacuum Switching Valve (BVSV) to sense the coolant temperature; in this way, EGR function is limited to warm engine operation. All other engines use a Vacuum Solenoid Valve (VSV) connected to the Engine Control Module (ECM). The computer receives many inputs regarding engine status and temperature; when conditions are favorable, the VSV is activated, allowing EGR function.

Additionally, EGR function is controlled by manifold vacuum so that the valve only operates during periods of high-load or high rpm driving. A binding EGR valve (either open or closed) can cause stalling, missing or reduced fuel economy.

SYSTEM TESTING

2RZ-FE and 3RZ-FE Engines

➧ See Figures 21, 22 and 23

1. Remove the EGR vacuum modulator cap and filter.
2. Check the filter for damage or contamination.

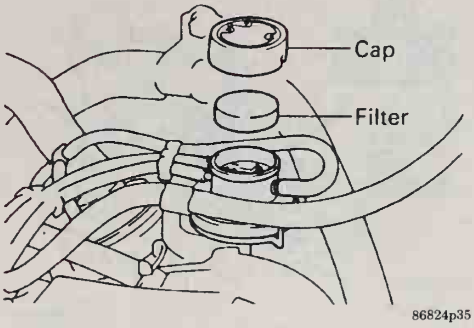


Fig. 21 The filter is directly beneath the cap

3. With compressed air, clean the filter.
4. Reinstall the filter and cap. Install the filter with the coarser surface facing the atmospheric side (outwards).
5. Using a 3-way connector, attach a vacuum gauge to the hose between the EGR valve and the EGR vacuum modulator.
6. Start the engine and check that the engine starts and runs at idle.

➡The engine coolant temperature should be below 122°F (20°C).

7. Check that the vacuum gauge indicates zero at 3000 rpm.
8. Check that the EGR pipe is not hot.
9. Remove the 3-way connector with the vacuum hose.
10. Connect the vacuum hose from port **Q** of the EGR modulator to the EGR valve.
11. Plug the hose from the VSV to the EGR.
12. Remove the vacuum gauge, then reconnect the vacuum hoses to their proper locations.
13. Apply vacuum directly to the EGR valve with the engine at idle.

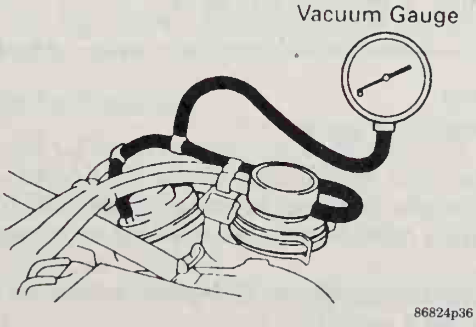


Fig. 22 Install a vacuum gauge to the hose between the EGR valve and vacuum modulator

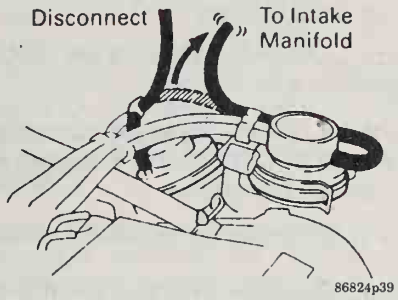


Fig. 23 Apply vacuum directly to the EGR valve while the engine is idling

14. Check that the engine now idles rough or stalls.
15. Reconnect the vacuum hoses to their proper locations.

1FZ-FE Engines

1. Check the filter in the EGR modulator for contamination and clean using compressed air.
2. Using a 3-way connector, connect a vacuum gauge in-line between the valve and vacuum pipe. Check that the engine starts and idles smoothly.

➡For accurate system testing, the coolant temperature should be below 117°F (47°C).

3. Accelerate the engine to 2500 rpm and verify that the vacuum gauge reads 0 in. Hg.
4. Check that the EGR pipe is not hot.

➡For accurate test results, the engine coolant temperature must now be above 127°F (53°C)

5. Check that the vacuum gauge reads low vacuum at 2500 rpm.
6. Disconnect the vacuum hose from port **R** of the EGR vacuum modulator and connect port **R** directly to the intake manifold.
7. Check that the vacuum reading is high at 2500 rpm. As large amounts of vacuum enters the engine, the engine idle quality may be adversely affected.
8. Remove the vacuum gauge and reconnect the vacuum hoses in their original locations.
9. Apply vacuum directly to the EGR valve with the engine at idle.
10. If the EGR valve is operating properly, the engine should misfire, run rough and possibly stall. Reconnect the vacuum hoses in their proper locations.

22R-E and 3VZ-E Engines

1. Check the filter in the EGR modulator for contamination and clean using compressed air.
2. Using a 3-way connector, connect a vacuum gauge in-line between the valve and vacuum pipe.

3. Check that the engine starts and idles smoothly.

➡For accurate system testing, the coolant temperature should be below 118°F (48°C) on 3VZ-E engines or below 93°F (34°C) on 22R-E engines.

4. Accelerate the engine to 3500 rpm and verify that the vacuum gauge reads 0.

➡For accurate test results, the engine coolant temperature must be above 126°F (52°C) on 3VZ-E engines or above 104°F (40°C) on 22R-E engines.

5. Check that the vacuum gauge reads low vacuum at 3500 rpm.
6. Disconnect the vacuum hose from port **R** of the EGR vacuum modulator and connect port **R** directly to the intake manifold.
7. Check that the vacuum reading is high at 3000 rpm. As large amounts of vacuum enters the engine, the engine idle quality may be adversely affected.
8. Remove the vacuum gauge and reconnect the vacuum hoses in their original locations.
9. Apply vacuum directly to the EGR valve with the engine at idle. If the EGR valve is operating properly, the engine should run rough or possibly stall.
10. Reconnect the vacuum hoses in their proper locations.

5VZ-FE Engine

➧ See Figures 24 and 25

1. Remove the EGR vacuum modulator cap and filter.
2. Check the filter for damage or contamination.
3. With compressed air, clean the filter.
4. Reinstall the filter and cap. Install the filter with the coarser surface facing the atmospheric side (outwards).
5. Using a 3-way connector, attach a vacuum gauge to the hose between the EGR valve and the VSV.
6. Start the engine and check that the engine starts and runs at idle.
7. Using the SST 09843-18020 or an equivalent jumper wire, connect terminals TE1 and E1 of the DLC1 under the hood.

➡The engine coolant temperature should be below 113°F (45°C).

8. Check that the vacuum gauge indicates zero at 2800 rpm.
9. Check that the EGR pipe is not hot.

➡Allow the engine to run until the coolant temperature is above 176°F (80°C).

10. Check that the vacuum hose gauge reads low vacuum at 2800 rpm.
11. Disconnect the hose from port **R** of the EGR vacuum modulator and connect port **R** directly to the intake manifold with another hose.
12. Check the vacuum gauge, it should read high vacuum at 3500 rpm.
13. Disconnect terminals TE1 and E1 by removing the jumper wire.
14. Remove the vacuum gauge, and reconnect the vacuum hoses to their proper locations.

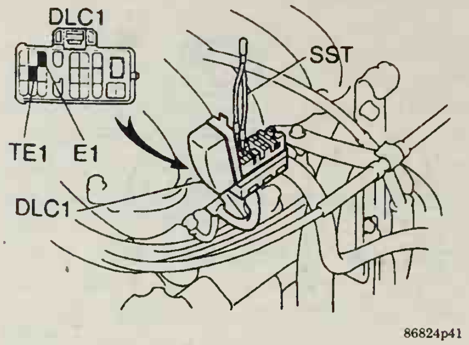


Fig. 24 The TE1 and E1 connections are located in the DLC1

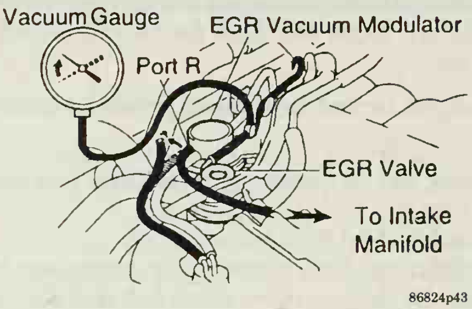


Fig. 25 Connect the vacuum gauge as shown

15. Apply vacuum directly to the EGR valve with the engine at idle.
16. Check that the engine idles rough or stalls.

REMOVAL & INSTALLATION

EGR Valve

➧ See Figures 26 and 27

1. Disconnect the EGR pipe, discard of the gasket.
2. Label and disconnect the vacuum hoses, EGR hose, water bypass hoses from the IAC valve and water bypass pipe.
3. Some models have an EGR sensor, remove the screws attaching this if applicable.
4. Remove the 2 nuts holding the valve to the engine. Discard the old gasket.
5. Inspect the valve for sticking and heavy carbon deposits.

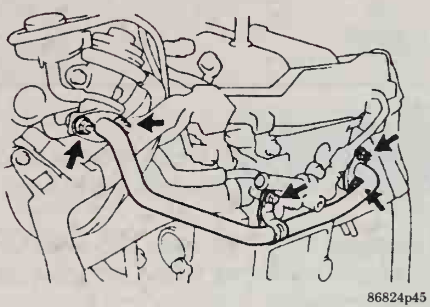


Fig. 26 Detach the EGR pipe from the valve and mounting points on the engine

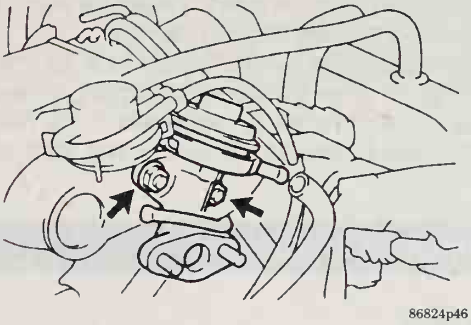


Fig. 27 Remove the two mounting nuts retaining the valve to the engine

To install:

6. With a new gasket, mount the valve to the engine. Tighten the mounting nuts to 14 ft. lbs. (19 Nm).
7. Install the EGR sensor if removed.
8. Attach the EGR pipe with a new gasket.
9. Attach the labeled hoses to their proper locations.
10. Start the vehicle and check for any leaks.

EGR Vacuum Modulator

1. Label and disconnect the hoses attached to the modulator.
2. Loosen and remove the nut holding the tube from the modulator to the EGR valve.
3. Remove the modulator.
4. Check the hoses for signs of deterioration and replace as necessary.

To install:

5. Install the modulator and tighten the nut securely.
6. Connect the vacuum hoses.

Vacuum Switching Valve (VSV)

EXCEPT 1FZ-FE ENGINE

1. Disconnect the negative battery cable.
2. Disconnect the VSV electrical connector.
3. Label and remove the vacuum hoses.
4. Remove the VSV. Installation is the reverse of the removal procedure. During installation, check the vacuum hoses for deterioration and replace as necessary.

1FZ-FE ENGINE

1. Disconnect the negative battery cable.
2. Remove the air intake chamber as follows:
   a. Drain the engine coolant. Disconnect the cruise control cable, accelerator cable and the throttle cable at the throttle body.
   b. Disconnect the vacuum hoses and the EGR gas temperature sensor connector at the EGR valve.
   c. Loosen the EGR pipe union nut. Remove the 2 nuts holding the EGR valve and air intake chamber.
   d. Remove the 2 stud bolts, EGR valve and vacuum modulator assembly.
   e. Remove the bolt holding the heater pipe and the air intake chamber. Disconnect the air cleaner hose, if still attached.
3. Label and disconnect the PCV hoses. Label and disconnect the remaining vacuum hoses. Disconnect the brake booster hose.
4. Disconnect the water bypass hose and the EVAP hose. Unsecure the connector from the emission control valve set assembly, throttle position sensor and the Idle Air Control (IAC) valve.
5. Remove the power steering reservoir tank mounting bolts and position tank aside. Disconnect the fluid lines should not be necessary.
6. Remove the engine oil dipstick and guide. Remove the O-ring from the end of the dipstick guide.
7. Disconnect the engine ground strap.
8. Remove the air intake chamber nuts and bolts and 2 gaskets.
9. Disconnect the vacuum hoses from the the air intake chamber.
10. Remove the 4 mounting bolts and the emission control valve set assembly.
11. Disconnect the harness and 2 vacuum hoses. Remove the screws securing the VSV.

To install:

12. Install the VSV with the mounting screws.
13. Connect the 2 vacuum hoses and the harness connector to the VSV.
14. Install the emission control valve set with the 4 mounting bolts and tighten to 14 ft. lbs. (20 Nm).
15. Connect the vacuum hoses to the air intake chamber.
16. Reinstall the air intake chamber as follows:
   a. Clean the old gasket material from all mating surfaces. Install 2 new gaskets and the air intake chamber with the mounting nuts and bolts. Torque fasteners to 14 ft. lbs. (21 Nm).
17. Connect the heater bypass hoses. Connect the engine ground strap.
18. Install new O-ring to the bottom of the oil dipstick guide and lubricate lightly with clean engine oil. Install the guide into

the hole in the oil pan and tighten the retainer bolts to 14 ft. lbs. (20 Nm).

19. Install the power steering reservoir in position and secure in place. Tighten the mounting bolts to 13 ft. lbs. (18 Nm).
20. Connect the harness connectors to the emission control valve set assembly, throttle position sensor and IAC valve.
21. Connect the vacuum hoses and the water bypass hoses. Install the air cleaner hose.
22. Install the bolt holding the heater inlet and intake chamber, tightening to 14 ft. lbs. (20 Nm).
23. Install a new gasket, EGR valve and vacuum modulator assembly with the mounting bolts. Tighten bolts to 8 ft. lbs. (10 Nm). Install the 2 nuts holding the EGR valve and air intake chamber and tighten to 14 ft. lbs. (19 Nm).
24. Tighten the union nut of the EGR pipe to 47 ft. lbs. (64 Nm). Connect the EGR gas temperature sensor connector a 3 vacuum hoses to the EGR valve.
25. Connect the throttle cable, accelerator cable and cruise control actuator cable to the throttle body.
26. Fill the cooling system and inspect for leaks.
27. Connect the negative battery cable.

EGR Gas Temperature Sensor

1. Disconnect the negative battery cable. Remove the vacuum modulator.
2. Disconnect the sensor electrical harness.
3. Unscrew the sensor to the EGR valve.

To install:

4. When installing the sensor, coat the threads with anti-seize compound.
5. Tighten the unit to 14 ft. lbs. (20 Nm).
6. Engage the electrical connections.

Bimetal Vacuum Switching Valve (BVSV)

1. Drain the engine cooling system.
2. Unplug and label the vacuum hoses from the valve.
3. Remove the valve using an appropriate sized wrench.

To install:

4. Apply liquid sealer to the bottom threads and install the valve. Tighten the valve to 18 ft. lbs. (25 Nm).
5. Connect the vacuum hoses and refill the engine cooling system.

Catalytic Converter

OPERATION

The catalytic converter is a muffler-like container built into the exhaust system to aid in the reduction of exhaust emissions. When the exhaust gases come into contact with the catalyst, a chemical reaction occurs which reduces the pollutants into harmless substances such as water and carbon dioxide.

There are two types of catalytic converters: an oxidizing type and a three-way type. Both are used on Toyota trucks, although the oxidation type is found only with the 22R engine. The oxidizing catalyst requires the addition of oxygen to spur the catalyst into reducing the engine's HC and CO emissions into H_2O and CO_2.

PRECAUTIONS

- Use only unleaded fuel.
- Avoid prolonged idling; the engine should run no longer than 20 min. at curb idle and no longer than 10 min. at fast idle.
- Don't disconnect any of the spark plug leads while the engine is running. If any engine testing procedure requires disconnecting or bypassing a control component, perform the procedure as quickly as possible. A mis-firing engine can overheat the catalyst and damage the oxygen sensor.
- Make engine compression checks as quickly as possible.
- Whenever under the vehicle or around the catalytic converter, remember that it has a very high outside or skin temperature. During operation, the catalyst reach high temperatures to work efficiently. Be very wary of burns, even after the engine has been shut off for a while. Additionally, because of the heat, never park the vehicle on or over flammable materials, particularly dry grass or leaves. Inspect the heat shields frequently and correct any bends or damage.
- In the unlikely event that the catalyst must be replaced, DO NOT dispose of the old one where anything containing grease, gas or oil can come in contact with it. The catalytic action with these substances will result in heat which may start a fire.

Air Injection System

OPERATION

➧ See Figures 28, 29, 30 and 31

➡This system is used on the 22R and 3F-E engines only.

Some unburned HC and CO remains in the exhaust flow after it leaves the cylinder. To encourage further burning in the exhaust port, compressed air from the air pump is blown into the exhaust port. This generally takes place during low and medium speed driving or during high speed deceleration. The engine control computer uses input signals from the rpm, the coolant temperature sensor and the engine vacuum sensor to control the function of the Vacuum Solenoid Valve (VSV). The VSV acts as a gatekeeper for the system, turning it on and off by controlling vacuum. Within the system, further control is maintained by both the Air Bypass and Air Switching Valves (ABV/ASV).

TESTING

Air Pump

➡Do not hammer, pry, or bend the pump housing while tightening the drive belt or testing the pump.

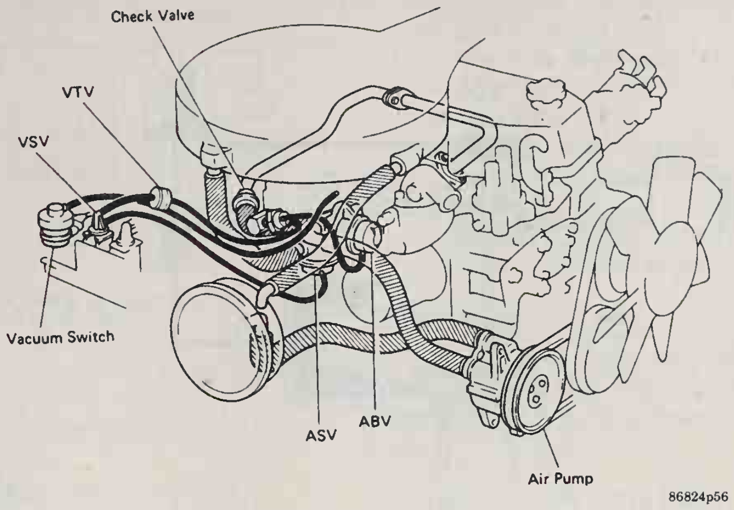

Check Valve
VTV
VSV
Vacuum Switch
ASV
ABV
Air Pump
86824p56

Fig. 28 Air injection system components — 22R engine

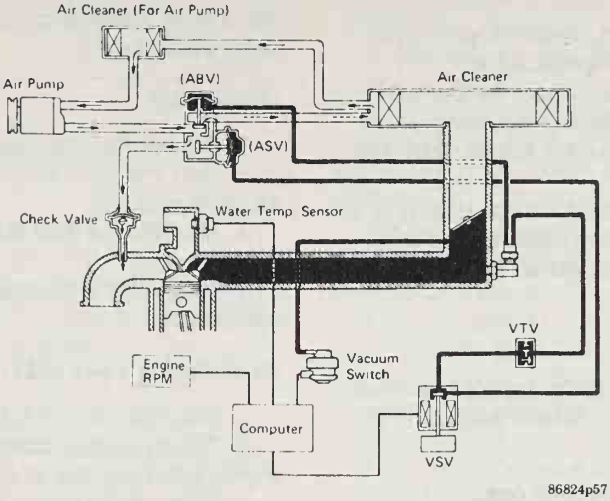

Air Cleaner (For Air Pump)
Air Pump
(ABV)
Air Cleaner
(ASV)
Check Valve
Water Temp Sensor
VTV
Engine RPM
Vacuum Switch
Computer
VSV
86824p57

Fig. 29 Air injection system schematic — 22R engine

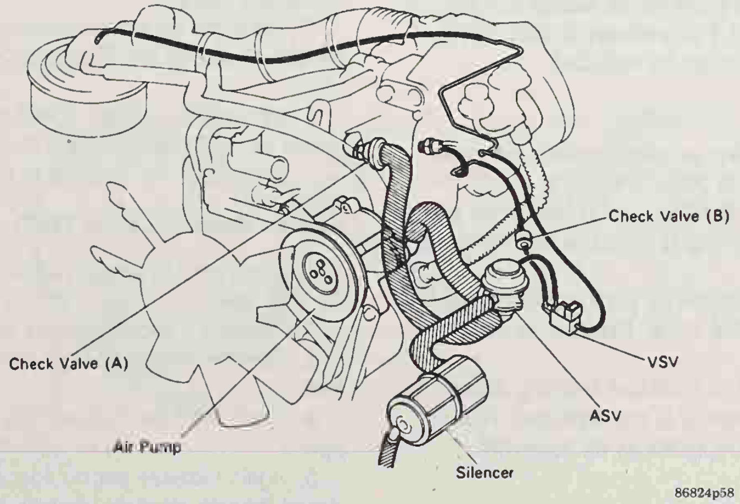

Check Valve (B)
Check Valve (A)
VSV
ASV
Air Pump
Silencer
86824p58

Fig. 30 Air injection system components — 3F-E engine

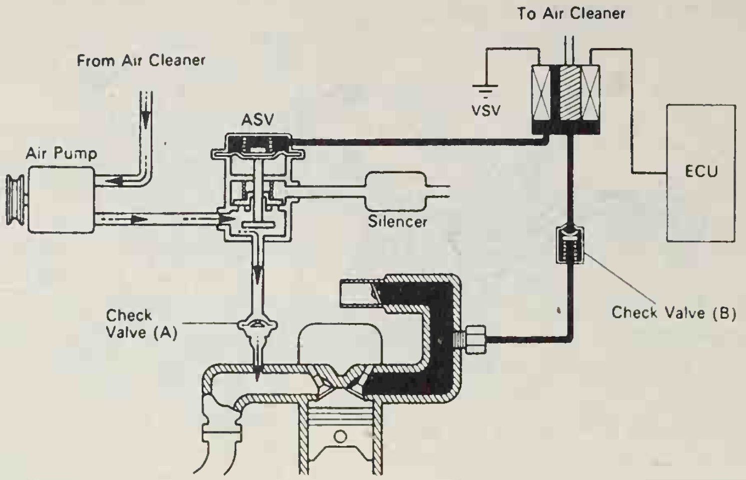


Fig. 31 Air injection system schematic — 3F-E engine

BELT TENSION AND AIR LEAKS

1. Before proceeding with the tests, check the pump drive belt tension to ensure that it is within specifications.
2. Turn the pump by hand. If it has seized, the belt will slip, making a noise. Disregard any chirping, squealing, or rolling sounds from inside the pump; these are normal when it is turned by hand.
3. Check the hoses and connections for leaks. Hissing or a blast of air is indicative of a leak. Soapy water, applied lightly around the area in question, is a good method for detecting leaks.

AIR OUTPUT

1. Disconnect the air supply hose at the anti-backfire valve.
2. Attach a vacuum gauge, using a suitable adaptor, to the air supply hose.

➡If there are two hoses, plug the second one.

3. With the engine at normal operating temperature, increase the idle speed and watch the vacuum gauge.
4. The air flow from the pump should be steady and fall between 2-6 psi. (14-41 kPa). If it is unsteady or falls below this, the pump is defective and must be replaced.

PUMP NOISE DIAGNOSIS

The air pump is normally noisy; as engine speed increases, the noise of the pump will rise in pitch. The rolling sound the pump bearing make is normal. But if this sound becomes excessive at certain speeds, the pump is defective and will have to be replaced.

A continual hissing sound from the air pump pressure relief valve at idle, indicates a defective valve. Replace the relief valve.

If the pump rear bearing fails, a continual knocking sound will be heard. Since the rear bearing is not separately replaceable, the pump will have to be replaced as an assembly.

Anti-Backfire Valve (ABV)

The ABV is easily checked with the engine running at idle. Disconnect the small vacuum hose from the valve, then reconnect it. At the time of reconnection, check the end of the large output hose; a momentary burst of compressed air from the pump should be felt.

Check Valve

1. Remove the check valve.
2. Blow into the manifold side (large side) and check that the valve is closed.
3. Blow into the ASV side (small side) and check that the valve is open.
4. If the valve is not operating properly it requires replacement.

Air Switching Valve (ASV)

1. Disconnect the air bypass hose from the air cleaner.
2. With the engine coolant cold, below 43°F (6°C), start the engine and check that air is discharged from the bypass hose.
3. Warm up the engine to normal operating temperature. Plug the hose. Reconnect the vacuum line.
4. With the engine idling, check that no air comes out of the bypass hose.
5. Race the engine momentarily and quickly release the throttle; air should be momentarily discharged from the bypass hose.
6. Increase the engine speed to a steady 3000 rpm; air should be discharged through the hose.
7. Reconnect the air hose to the air cleaner.

Vacuum Switching Valve (VSV)

1. Disconnect the hose between the VSV and the ASV at the VSV side.
2. Connect a vacuum gauge to the VSV port.
3. Run the engine at 4800 rpm; the gauge should read zero.
4. Pinch the hose between the vacuum switch and the air pipe.
5. Again increase engine speed to 4800 rpm; the gauge should indicate manifold vacuum.
6. Disconnect the vacuum gauge and reconnect the hose to the VSV.

REMOVAL & INSTALLATION

Air Pump

1. Label and disconnect the air hoses from the pump.
2. Loosen the bolt on the adjusting link and remove the drive belt.
3. Remove the mounting bolts and withdraw the pump.

To install:

➡Do not pry on the pump housing, it may become distorted.

4. Attach the air pump to the vehicle with the mounting bolts. Tighten the bolts until snug.
5. Adjust the drive belt tension after installation.
6. Attach the hoses to the pump.
7. Start the engine and check for proper operation.

Air Suction System

OPERATION

▶ See Figures 32, 33 and 34

➡This system only applies to the 22R-E and 3VZ-E engines.

This system is used to introduce extra fresh air into the exhaust ports to accelerate oxidation and after-burn of exhaust gases. This helps reduce HC and CO emissions. The system uses vacuum generated by the exhaust pulses in the manifold to control the entry of fresh air into the system.

TESTING

System Testing

1. With the engine cold, but running at idle, disconnect the air suction hose from the air cleaner.
2. A bubbling or gurgling noise should be heard from the hose (22R-E) or pipe (3VZ-E).
3. Warm the engine to normal operating temperature.
4. Again listen for the noise; it should not be heard with the engine warm.
5. Race the engine above 2000 rpm.
6. On 3VZ-E, the noise should reappear within 2-6 seconds.
7. On 22R-E, quickly close the throttle from 2000 rpm. The noise heard in the hose should stop momentarily.

Reed Valve

The reed valve should be checked with vacuum applied to the diaphragm. With vacuum applied, air should pass through the valve. With vacuum removed, the valve should not conduct air.

Vacuum Solenoid Valve (VSV)

1. Perform these tests with the ignition **OFF**. Unplug the wiring connector and vacuum hoses from the VSV.
2. Use jumper wires to connect the terminals of the valve to the battery terminals.
3. Blow into the port closest to the body of the valve. Air should come out the other port
4. Disconnect the jumpers from the battery. Again blow into the port nearest the body of the valve; air should not come out the other port and should come out of the air filter on the side of the valve.
5. Use an ohmmeter to check for a short in the valve. Place one probe against the body of the valve and check each terminal for continuity. No continuity should exist between either terminal and the body of the valve.
6. Measure resistance across the pins of the terminal. With the valve at 68°F (20°C), resistance should be 30-50 ohms. Resistance will vary with temperature; use good judgment when interpreting test results.
7. Reinstall the valve if it was removed. Connect the hoses and wire harness.

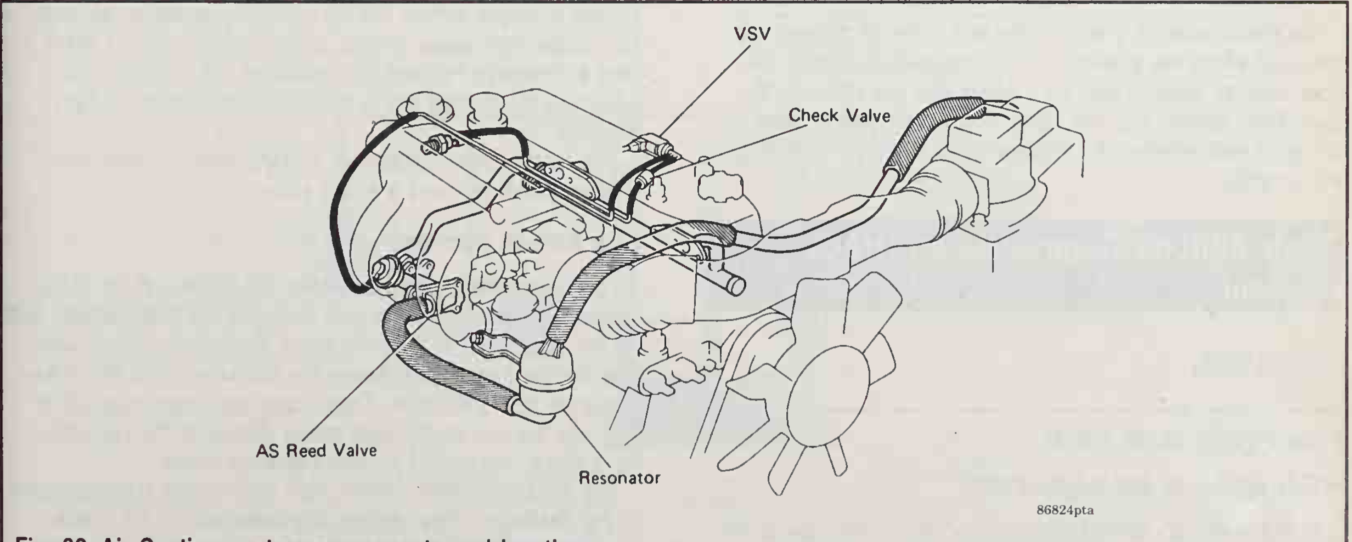


Fig. 32 Air Suction system components and locations

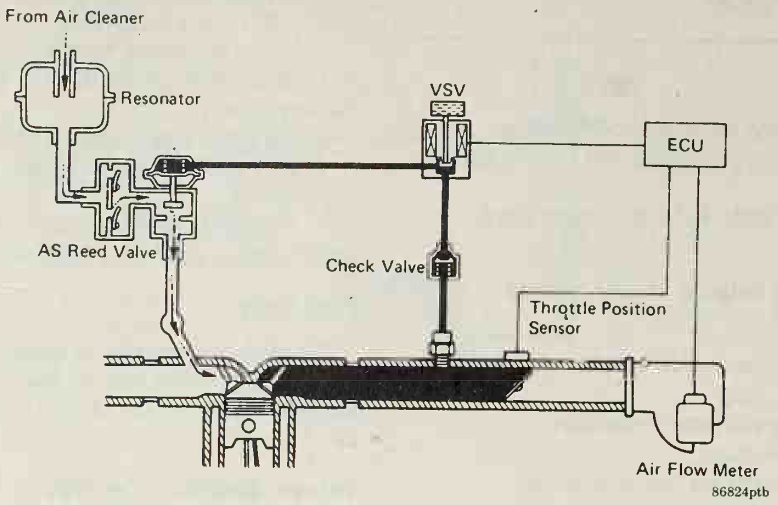


Fig. 33 System schematic and air flow

To reduce HC and CO emissions, this system draws in air into exhaust ports to accelerate oxidation, using vacuum generated by the exhaust pulsation in the exhaust manifold.

Condition	Coolant Temp.	Throttle valve position	Vehicle speed	Engine RPM	VSV	AS
Normal driving	Below 30°C (86°F)	—	—	Below 3,600 rpm	ON	ON
				Above 3,600 rpm	OFF	OFF
Deceleration	Above 40°C) (104°F)	Idling	Below 4 km/h (2 mph)	Below 1,000 rpm	OFF	OFF
				Above 1,000 rpm	ON	ON
			Above 4 km/h (2 mph)	Below 1,000 rpm	ON	ON
				Above 1,000 rpm	ON	ON

86824ptc

Fig. 34 Air Suction system operating conditions

Check Valve

The check valve is a simple one-way valve to prevent vacuum loss within the system. The colored side is always the input side, so blowing into the colored side will allow air to pass. Blow (gently) into the black side; no air should pass. If the valve was removed for testing, make certain it is reinstalled correctly.

High Altitude Compensation (HAC) System

OPERATION

➧ See Figures 35, 36 and 37

➡This applies to 22R engines only.

At high altitudes, air/fuel mixtures become richer, due to the thinner air available. The High Altitude Compensation (HAC) system installed on trucks sold in federally designated areas insures a proper air/fuel mix by supplying additional air to the low and/or high speed circuits at high altitude (above 4000 feet) to minimize HC and CO emissions. The system also advances the ignition timing to improve driveability at high altitudes.

The HAC system consists of an HAC valve, a dual diaphragm distributor, and a check valve.

High Altitude Operation

Low atmospheric pressure allows the bellows in the HAC valve to expand and close port A. Intake manifold vacuum acts on the diaphragm in the HAC valve through the check valve, opening the passages between the carburetor and the atmosphere via the HAC valve. These open passages allow air to flow into the low and/or high speed circuits in the carburetor. As a result, the air/fuel mixture becomes leaner.

The intake manifold vacuum also acts on the sub-diaphragm in the distributor. This vacuum in maintained by the check valve, except in the following instance. Vacuum in the main

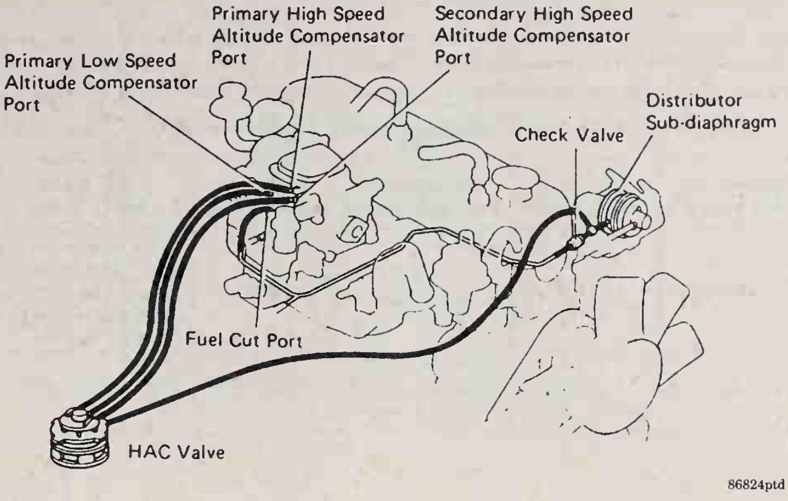

Primary High Speed Altitude Compensator Port
Secondary High Speed Altitude Compensator Port
Primary Low Speed Altitude Compensator Port
Distributor Sub-diaphragm
Check Valve
Fuel Cut Port
HAC Valve
86824ptd

Fig. 35 High Altitude Compensation (HAC) system components and locations

diaphragm of the distributor rises above (127mm Hg), the vacuum advance will revert to normal.

Low Altitude Operation

High atmospheric pressure, entering through the bottom of the HAC valve acts on the bellows and opens port A. Since the intake manifold vacuum does not act on the diaphragm in the HAC valve, the air passage from the carburetor to the atmosphere is closed by the diaphragm. This prevents a lean mixture at lower altitudes.

The intake manifold vacuum also cannot act on the distributor sub-diaphragm, so the distributor advance is normal.

TESTING

➡Before checking the HAC system at altitudes near 4000 ft. (12,192 m), determine the position of the HAC valve. This can be done by blowing into any one of the three ports on top of the HAC valve when the engine is idling. If the passage is open, the valve is in the high altitude position. If it is closed, the valve is in the low altitude position. When the position is determined, proceed with the appropriate high altitude or low altitude inspection.

At High Altitude

1. Check all vacuum hoses for leaks, breaks, kinks, or improper connections.
2. Visually inspect the HAC filter and replace it if clogged. It is located at the bottom of the HAC valve.
3. Disconnect the hoses from the distributor diaphragms and plug the end of each hose.
4. Start the engine and check the ignition timing. It should be 0 degrees (TDC).
5. Reconnect the hoses to the diaphragms while the engine is running. Recheck the timing; it should now be 12° BTDC.

At Low Altitude

1. Check all hoses for leaks, breaks, kinks, and improper connections.
2. Inspect the HAC filter, located in the bottom of the HAC valve, and replace it if clogged.

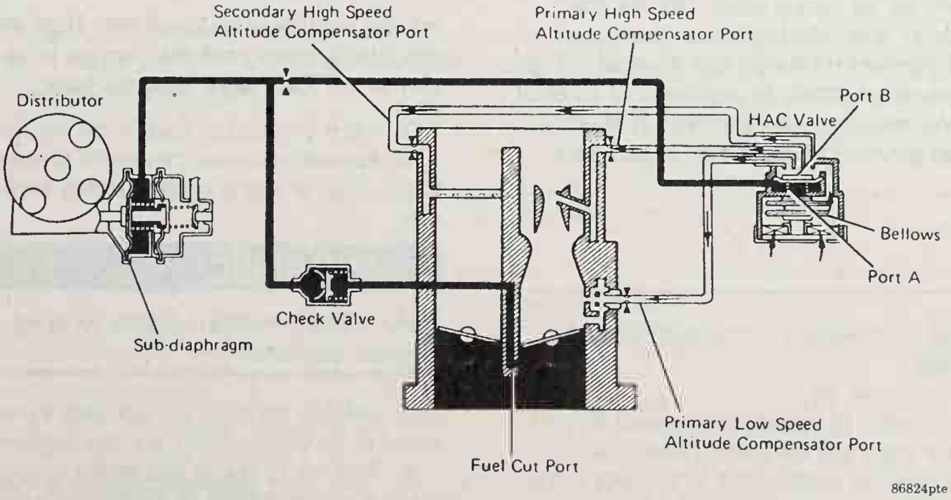

Secondary High Speed Altitude Compensator Port
Primary High Speed Altitude Compensator Port
Distributor
Port B
HAC Valve
Bellows
Port A
Check Valve
Sub-diaphragm
Primary Low Speed Altitude Compensator Port
Fuel Cut Port
86824pte

Fig. 36 HAC system schematic

As altitude increases, the air-fuel mixture becomes richer. This system insures proper air-fuel mixture by supplying additional air to the primary low and high speed circuits and secondary high speed circuit of the carburetor, and advances the ignition timing to improve driveability at high altitude (above 1,198 m (3,930 ft))

Altitude	Bellows in HAC Valve	Port A in HAC Valve	Distributor Sub-diaphragm	Port B in HAC Valve	Air from HAC Valve	Vacuum Ignition Timing
HIGH Above 1,198m (3,930 ft)	EXPANDED	CLOSED	PULLED (Always)	OPEN	Led into primary low and high speed circuits and secondary high speed circuit	ADVANCED (+12°) (Always)
LOW Below 783m (2,570 ft)	CONTRACTED	OPEN	NOT PULLED (PULLED only during idling)	CLOSED	STOPPED	INITIAL TIMING (ADVANCED (+12°) only during idling)

86824ptf

Fig. 37 HAC system operating conditions

3. Start the engine and disconnect the two HAC hoses from the carburetor.
4. If air is blown into each hose, it should not flow into the HAC valve. If it does, replace the valve.
5. Reconnect the two hoses. Check the ignition timing. If the timing is correct, the HAC system is okay. It should be 12° BTDC at 950 rpm.

Hot Air Intake (HAI) System

OPERATION

➧ See Figures 38, 39 and 40

➡This system only applies to the 22R engine.

This system allows hot air from around the exhaust manifold to be routed to the carburetor in cold weather. Instead of cold air being sucked into the air cleaner all the time, a thermovalve in the air cleaner housing closes when the temperature inside the air cleaner falls below a certain point. When the thermo valve is closed, a diaphragm on the air cleaner neck is activated and it opens the air control valve. This not only prevents cold outside air from entering the air cleaner, but allows the hotter air from around the exhaust manifold to flow in. This system improves driveability by maintaining a constant air intake temperature, resulting in more stable fuel atomization. It also serves to prevent carburetor icing in cold and moist weather.

TESTING

1. Visually inspect all hoses and connections for cracks, leaks or other damage.
2. Remove the air cleaner top.
3. Cool the thermo valve by blowing compressed air on it.
4. With the engine idling and the thermo valve closed (cool), check to see if the air control valve in the neck of the air cleaner is open and allowing hot air to enter the air cleaner.
5. Install the top of the air cleaner and run the engine until it reaches normal operating temperature.
6. Check that the air control valve is now closed and only cool air is being allowed to enter the air cleaner.

Deceleration Fuel Cut System

OPERATION

➧ See Figures 41, 42 and 43

➡This system only applies to the 22R engine.

This system cuts off part of the fuel in the slow circuit of the carburetor to prevent overheating and afterburning of the exhaust system.

TESTING

1. Connect a tachometer to the engine.
2. Start the engine and check that it runs normally.

➡If the vehicle is equipped with High Altitude Compensation (HAC), disconnect the vacuum hose from the lower port of the HAC valve. Plug the hose.

3. Pinch the vacuum hose to the vacuum switch.
4. Gradually increase the engine speed to 3000 rpm. Check that the engine misfires slightly between 2400 and 3000 rpm.

⁂WARNING

Perform this procedure quickly to avoid overheating the catalytic converter.

5. Release the hose and gradually increase the engine speed to 3000 rpm. Check that the engine operation is normal.
6. With the engine at idle unplug the solenoid valve. Check that the engine misfires or stalls.

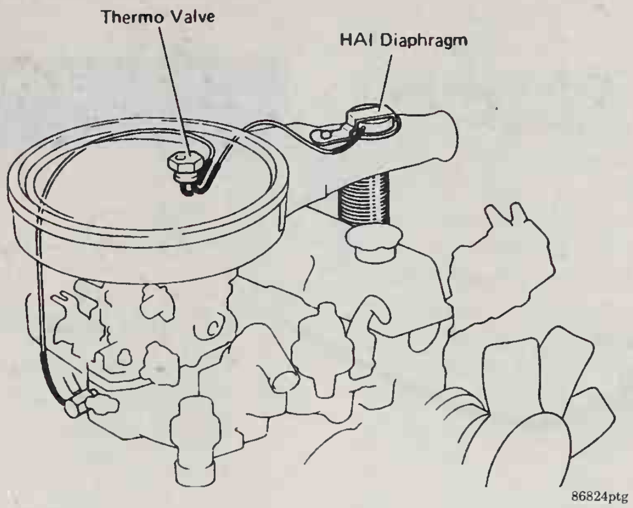

Thermo Valve
HAI Diaphragm
86824ptg

Fig. 38 The HAI system has two main companants, the thermo valve and the diaphragm

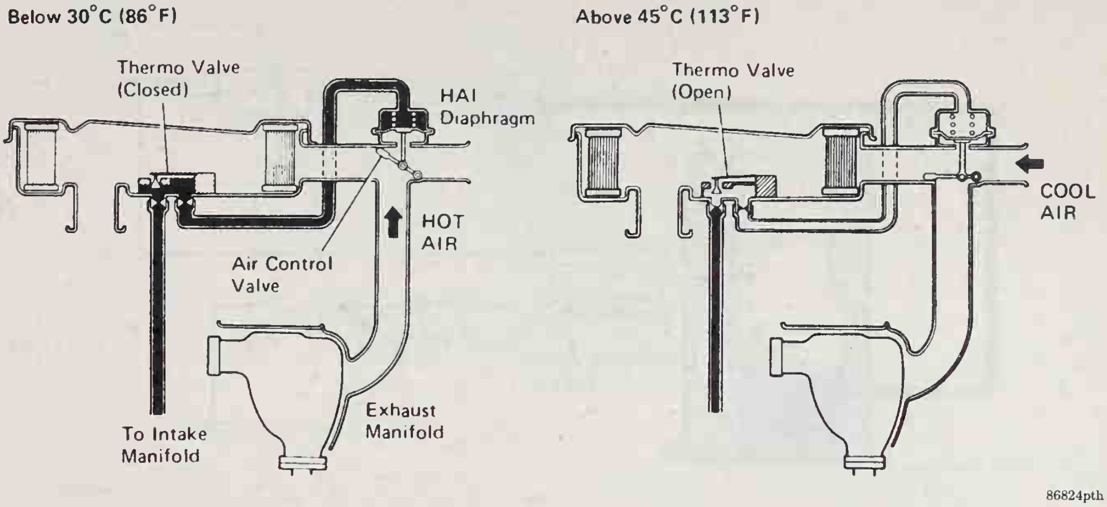

Below 30°C (86°F)
Thermo Valve (Closed)
HAI Diaphragm
HOT AIR
Air Control Valve
To Intake Manifold
Exhaust Manifold
Above 45°C (113°F)
Thermo Valve (Open)
COOL AIR
86824pth

Fig. 39 The thermo valve controls air flow according to the ambiant tempreture

This system leads a hot air supply to the carburetor in cold weather to improve driveability and to prevent the carburetor from icing in extremely cold weather.

Temperature in Air Cleaner	Thermo Valve	Air Control Valve	Intake Air
Cool Below 30°C (86°F)	CLOSED	Hot air passage OPEN	HOT
Hot Above 45°C (113°F)	OPEN	Cool air passage OPEN	COOL

86824pti

Fig. 40 HAI system operating conditions

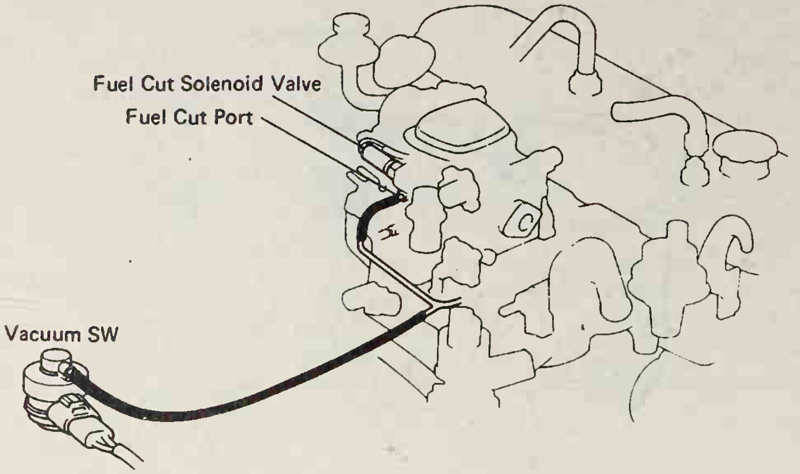

Fuel Cut Solenoid Valve
Fuel Cut Port
Vacuum SW
86824ptj

Fig. 41 Deceleration fuel cut system components and locations

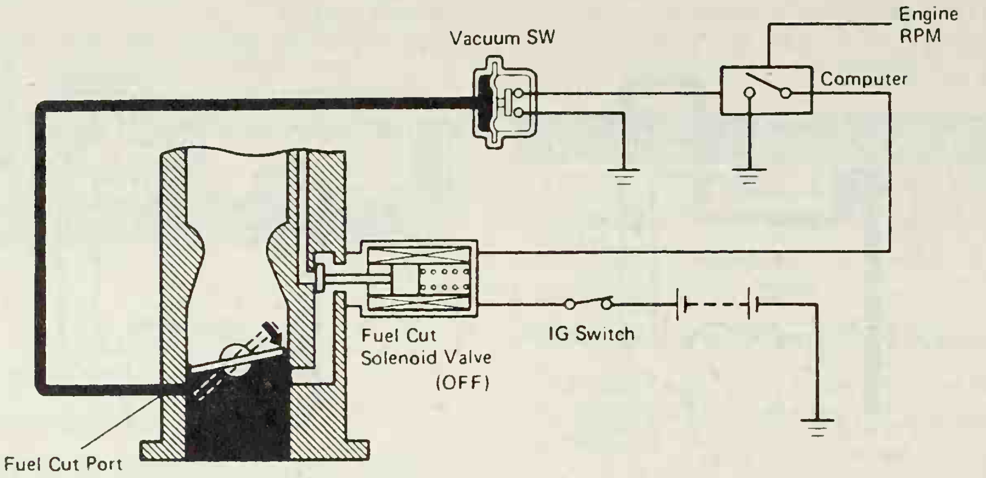

Vacuum SW
Engine RPM
Computer
Fuel Cut Solenoid Valve (OFF)
IG Switch
Fuel Cut Port
86824ptk

Fig. 42 Deceleration fuel cut system schematic

During deceleration this system cuts off part of the fuel in the slow circuit of the carburetor. This prevents overheating and afterburning in the exhaust system.

Engine RPM	Vacuum in the Vacuum SW	Vacuum SW	Computer	Fuel Cut Solenoid Valve	Slow Circuit in Carburetor
Below 1,810 rpm	Low vacuum below 370 mmHg (14.71 in.Hg, 49.3 kPa)	ON	ON	ON	OPEN
	High vacuum above 430 mmHg (16.93 in.Hg, 57.3 kPa)	OFF	ON	ON	OPEN
Above 2,200 rpm	Low vacuum below 370 mmHg (14.71 in.Hg, 49.3 kPa)	ON	ON	ON	OPEN
	High vacuum above 430 mmHg (16.93 in.Hg, 57.3 kPa)	OFF	OFF	OFF	CLOSED

86824ptl

Fig. 43 Deceleration fuel cut system operating conditions

7. Stop the engine and reconnect the wiring. Remove the tachometer.

Auxiliary Acceleration Pump (AAP) System

OPERATION

➧ See Figures 44, 45 and 46

➡This system is used on the 22R engines only.

To reduce emissions, carburetor air/fuel mixtures are calibrated to be as lean as possible. Although a lean mixture will burn readily at hotter temperatures, it is reluctant to ignite when cold because fuel vaporizes less readily when cold. Thus, increasing the amount of fuel in a cold air/fuel mixture increases the amount of vaporized fuel available.

The problem of a poor air/vaporized fuel mixture in a cold engine is accentuated when accelerating. Although the carburetor is equipped with an acceleration pump for the normal demands of an accelerating engine, its capacity is insufficient for a cold engine. The Auxiliary Acceleration Pump (AAP) is designed to send additional fuel into the acceleration nozzle in the carburetor independent of the regular acceleration pump.

The AAP itself is an integral part of the carburetor. It consists of two check valves controlled by springs and a diaphragm controlled by both a spring and engine vacuum. At constant speeds, intake manifold vacuum draws the AAP diaphragm back, enlarging the chamber and allowing gasoline to enter. When the engine is accelerated, intake manifold vacuum drops, allowing the AAP diaphragm to be pushed back by the spring. The resultant reduction in chamber volume forces the gasoline out through the other check valve, into the acceleration nozzle.

AAP operation is governed by the same switching valve used in the choke breaker system. At cold coolant temperatures, the valve allows intake manifold vacuum to reach the

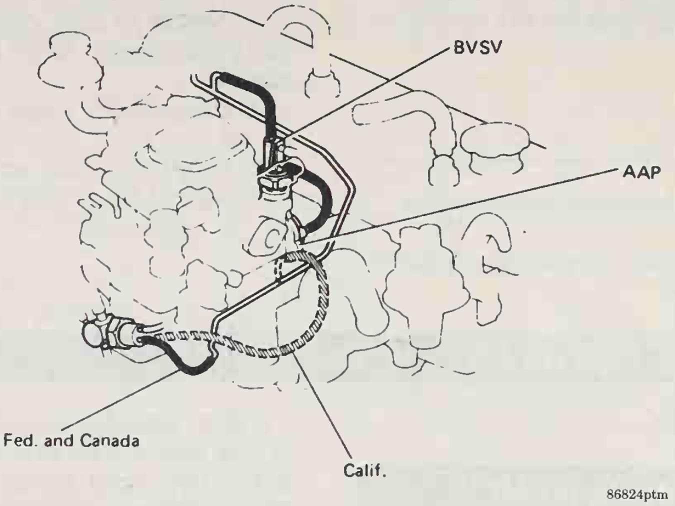


Fig. 44 Auxiliary Acceleration Pump (AAP) system components and locations

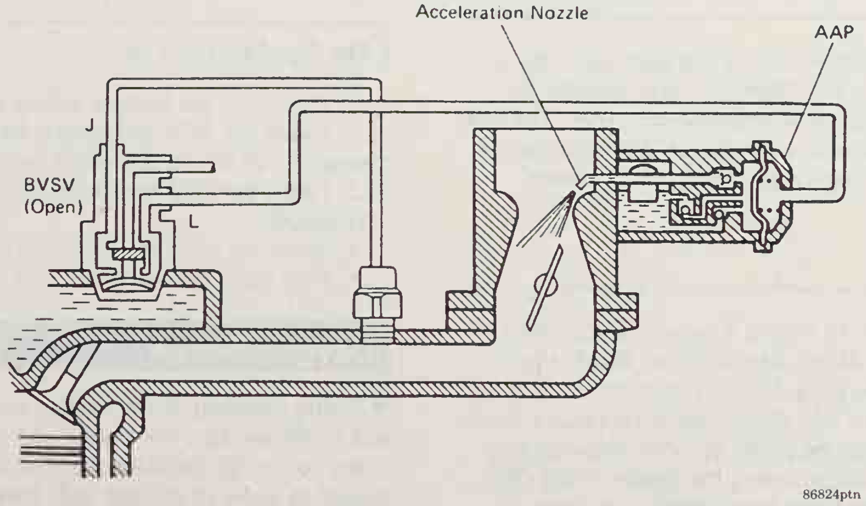
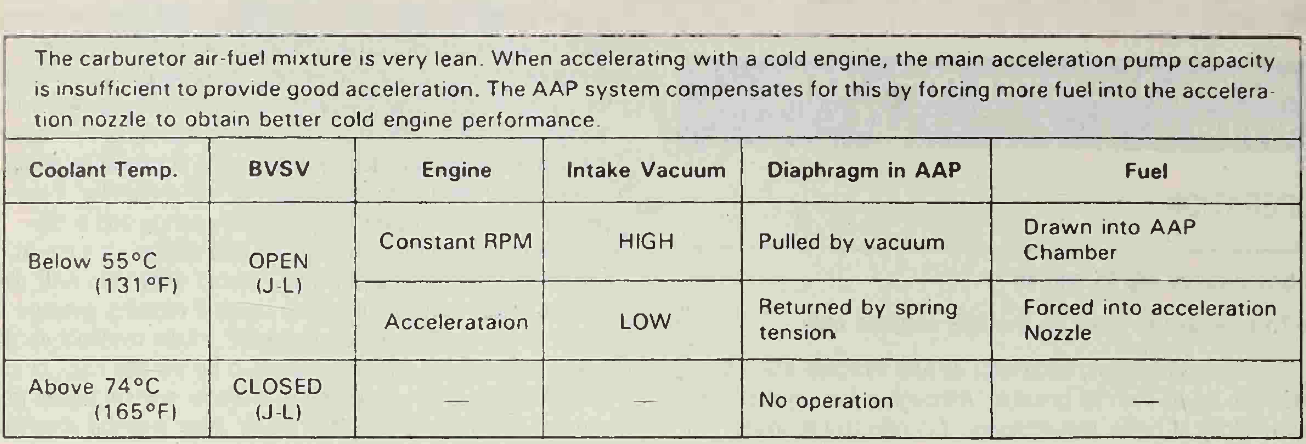


Fig. 45 AAP system schematic



The carburetor air-fuel mixture is very lean. When accelerating with a cold engine, the main acceleration pump capacity is insufficient to provide good acceleration. The AAP system compensates for this by forcing more fuel into the acceleration nozzle to obtain better cold engine performance.

Coolant Temp.	BVSV	Engine	Intake Vacuum	Diaphragm in AAP	Fuel
Below 55°C (131°F)	OPEN (J-L)	Constant RPM	HIGH	Pulled by vacuum	Drawn into AAP Chamber
		Acceleratoion	LOW	Returned by spring tension	Forced into acceleration Nozzle
Above 74°C (165°F)	CLOSED (J-L)	—	—	No operation	—

86824ptp

Fig. 46 AAP system operating conditions

AAP diaphragm. At approximately 131°F (55°C), it closes off the passage to vacuum, thus shutting off the AAP function on a fully warmed engine.

INSPECTION

The vacuum hose should be checked for leaks, kinks, or improper connection.

1. With the engine cold and idling, remove the air cleaner cap and look into the carburetor.
2. Pinch the AAP hose shut and stop the engine.
3. Release the hose; check that a spurt of gas is seen from the acceleration nozzle at the instant the vacuum hose is released.
4. Fully warm the engine to normal temperature and repeat the test.
5. No gasoline should spurt from the acceleration nozzle.
6. Reinstall the air cleaner.

ELECTRONIC ENGINE CONTROLS

➧ See Figures 47, 48, 49 and 50

Electronic Control Module (ECM)

OPERATION

The ECM receives signals from various sensors on the engine. It will then process this information and calculate the correct air/fuel mixture under all operating conditions. The ECM is a very fragile and expensive component. Always follow the precautions when servicing the electronic control system.

PRECAUTIONS

- Do not permit parts to receive a severe impact during removal or installation. Always handle all fuel injection parts with care, especially the ECM. DO NOT open the ECM cover!
- Before removing the fuel injected wiring connectors, terminals, ect., first disconnect the power by either disconnecting the negative battery cable or turning the ignition switch **OFF**.
- Do not be careless during troubleshooting as there are numerous amounts of transistor circuits; even a slight terminal contact can induce troubles.
- When inspecting during rainy days, take extra caution not to allow entry of water in or on the unit. When washing the engine compartment, prevent water from getting on the fuel injection parts and wiring connectors.

REMOVAL & INSTALLATION

➧ See Figures 51 and 52

1. Disconnect the negative battery cable.
2. Locate the ECM and release the lock, then pull out the connector. Pull on the connectors only!
3. Unbolt the ECM from its mounting area.

To install:

4. Mount the ECM on the vehicle in the proper location.
5. Fully insert the connector, then check that it is locked.

Oxygen Sensor

➡During handling of the oxygen sensor, do not hit the end of the sensor. The sensor can be easily damaged by impact or rough handling. Additionally, do not allow the sensor to come in contact with water or petroleum products.

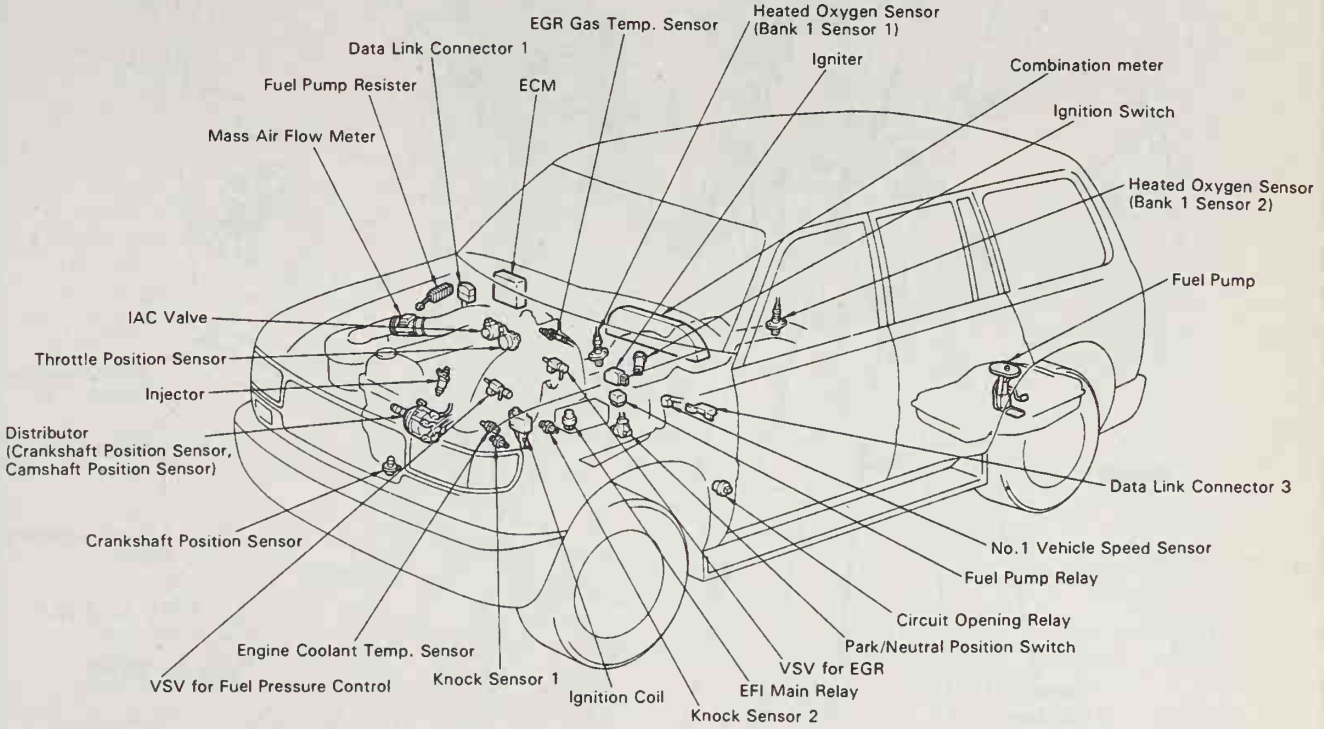

EGR Gas Temp. Sensor
Heated Oxygen Sensor (Bank 1 Sensor 1)
Data Link Connector 1
Igniter
Combination meter
Fuel Pump Resister
ECM
Ignition Switch
Mass Air Flow Meter
Heated Oxygen Sensor (Bank 1 Sensor 2)
Fuel Pump
IAC Valve
Throttle Position Sensor
Injector
Distributor (Crankshaft Position Sensor, Camshaft Position Sensor)
Data Link Connector 3
Crankshaft Position Sensor
No.1 Vehicle Speed Sensor
Fuel Pump Relay
Circuit Opening Relay
Park/Neutral Position Switch
Engine Coolant Temp. Sensor
VSV for EGR
Knock Sensor 1
VSV for Fuel Pressure Control
Ignition Coil
EFI Main Relay
Knock Sensor 2
86824p67

Fig. 47 Part locations of the electronic engine control system — 1FZ-FE shown

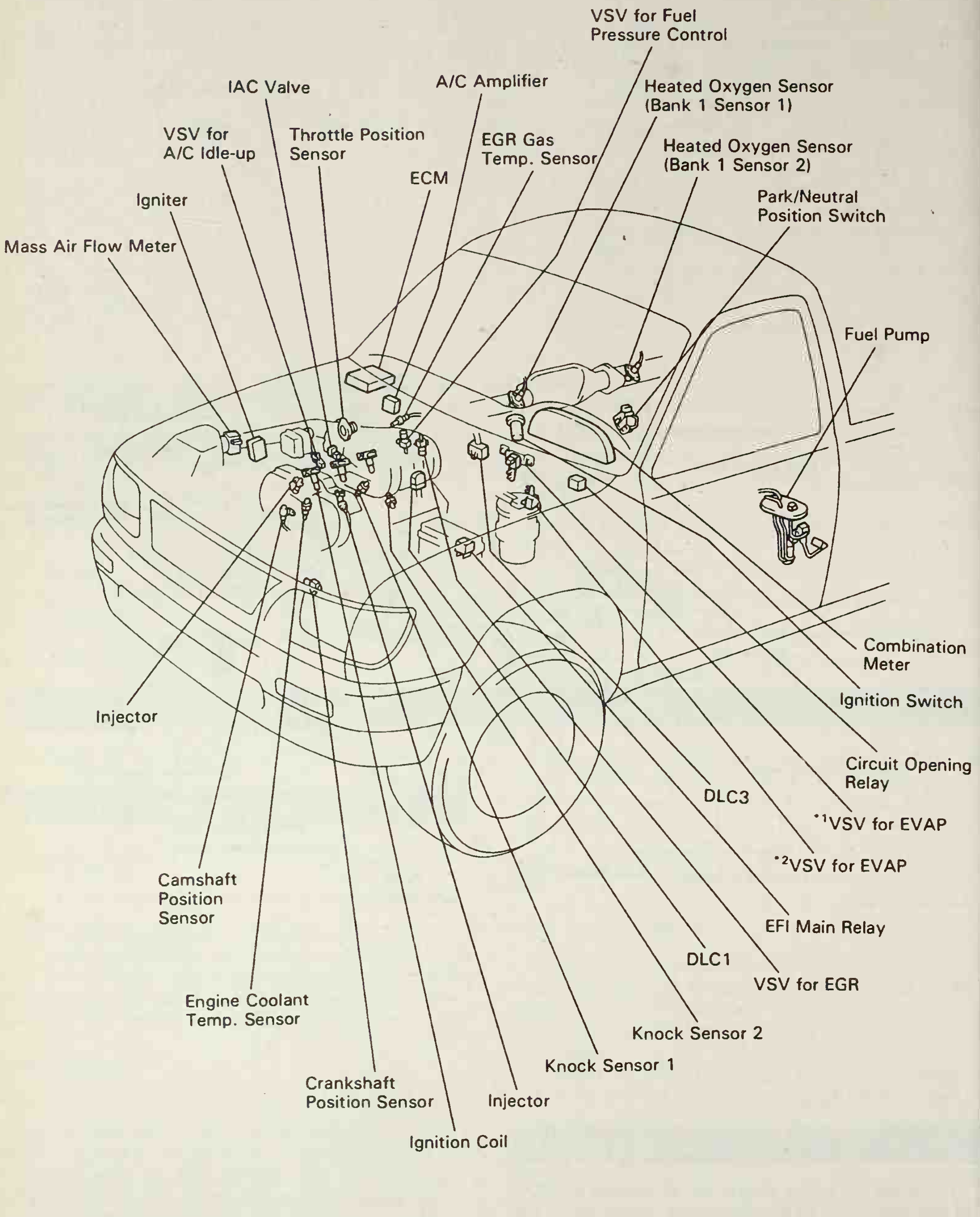

VSV for Fuel Pressure Control
IAC Valve
A/C Amplifier
Heated Oxygen Sensor (Bank 1 Sensor 1)
VSV for A/C Idle-up
Throttle Position Sensor
EGR Gas Temp. Sensor
Heated Oxygen Sensor (Bank 1 Sensor 2)
ECM
Igniter
Park/Neutral Position Switch
Mass Air Flow Meter
Fuel Pump
Combination Meter
Ignition Switch
Injector
Circuit Opening Relay
DLC3
*1VSV for EVAP
*2VSV for EVAP
Camshaft Position Sensor
EFI Main Relay
DLC1
VSV for EGR
Engine Coolant Temp. Sensor
Knock Sensor 2
Knock Sensor 1
Crankshaft Position Sensor
Injector
Ignition Coil
*1: California
*2: Except California
86824p68

Fig. 48 Part locations of the electronic engine control system — 5VZ-FE shown

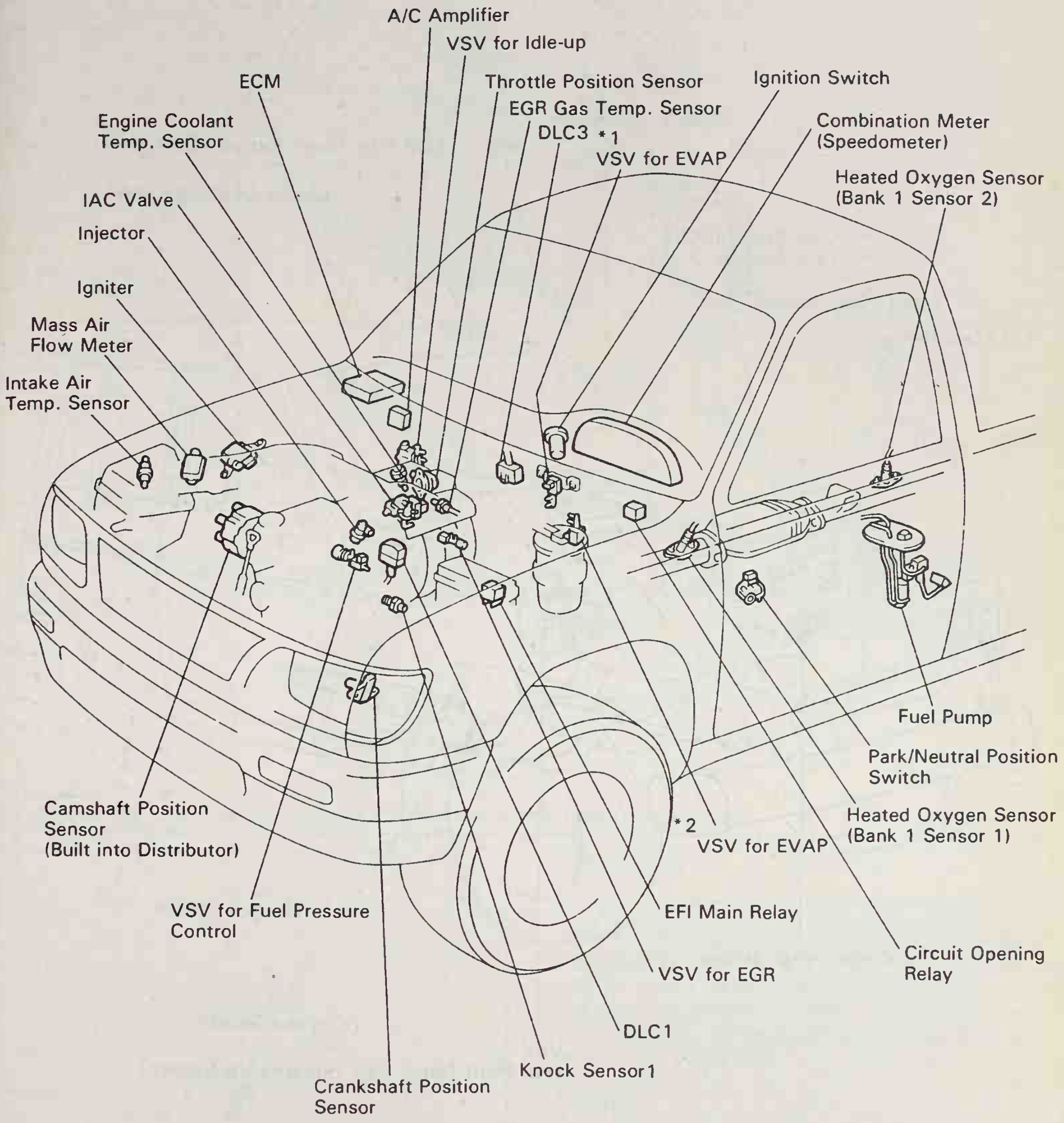

A/C Amplifier
VSV for Idle-up
ECM
Throttle Position Sensor
Ignition Switch
EGR Gas Temp. Sensor
Engine Coolant Temp. Sensor
DLC3 *1
Combination Meter (Speedometer)
VSV for EVAP
Heated Oxygen Sensor (Bank 1 Sensor 2)
IAC Valve
Injector
Igniter
Mass Air Flow Meter
Intake Air Temp. Sensor
Fuel Pump
Park/Neutral Position Switch
Camshaft Position Sensor (Built into Distributor)
*2 VSV for EVAP
Heated Oxygen Sensor (Bank 1 Sensor 1)
VSV for Fuel Pressure Control
EFI Main Relay
Circuit Opening Relay
VSV for EGR
DLC1
Knock Sensor1
Crankshaft Position Sensor
*1: California
*2: Except California
86824p69

Fig. 49 Part locations of the electronic engine control system — 2VZ-FE and 3VZ-FE shown

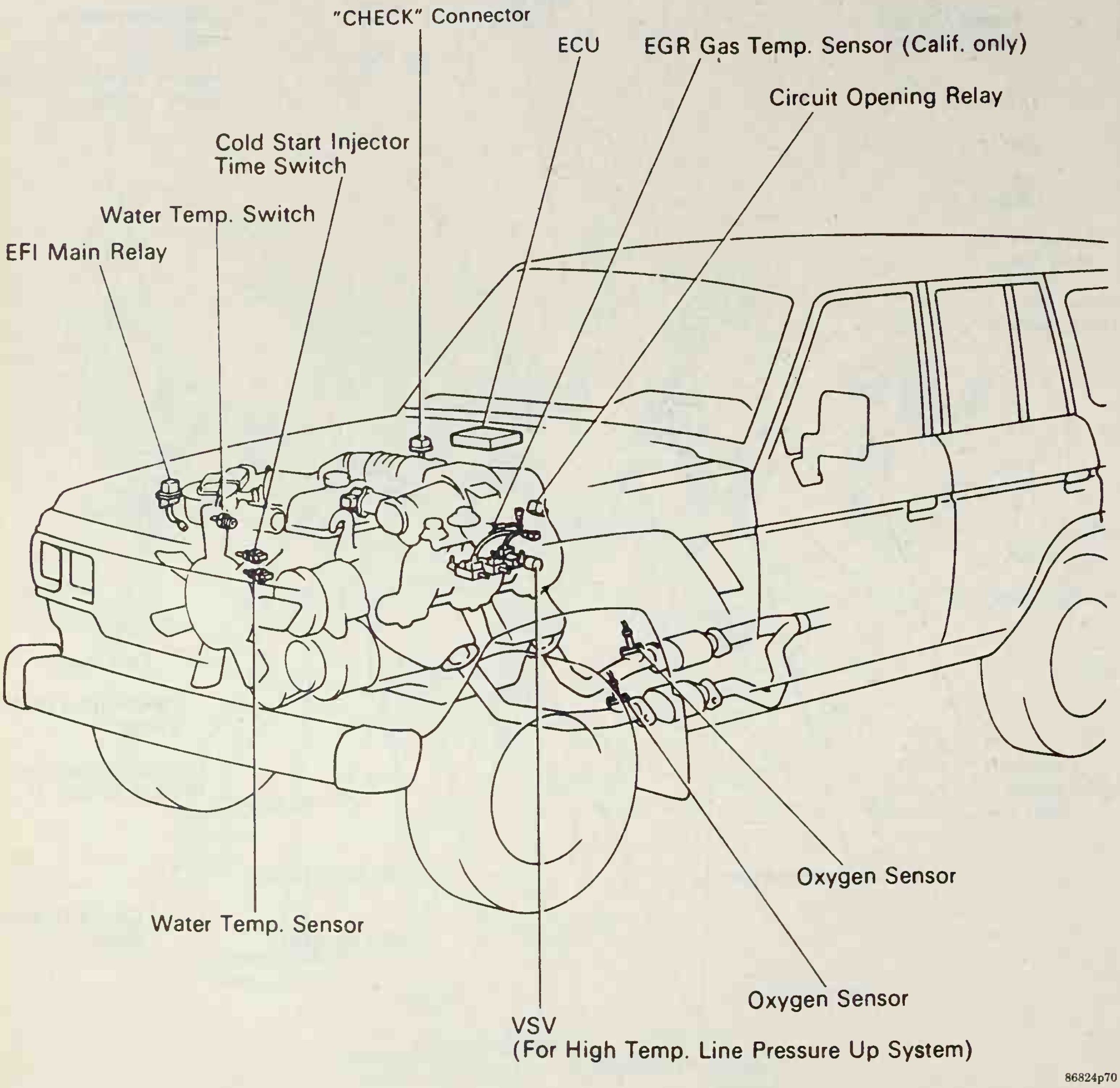

"CHECK" Connector
ECU
EGR Gas Temp. Sensor (Calif. only)
Circuit Opening Relay
Cold Start Injector Time Switch
Water Temp. Switch
EFI Main Relay
Oxygen Sensor
Water Temp. Sensor
Oxygen Sensor
VSV (For High Temp. Line Pressure Up System)
86824p70

Fig. 50 Part locations of the electronic engine control system — 3F-E shown

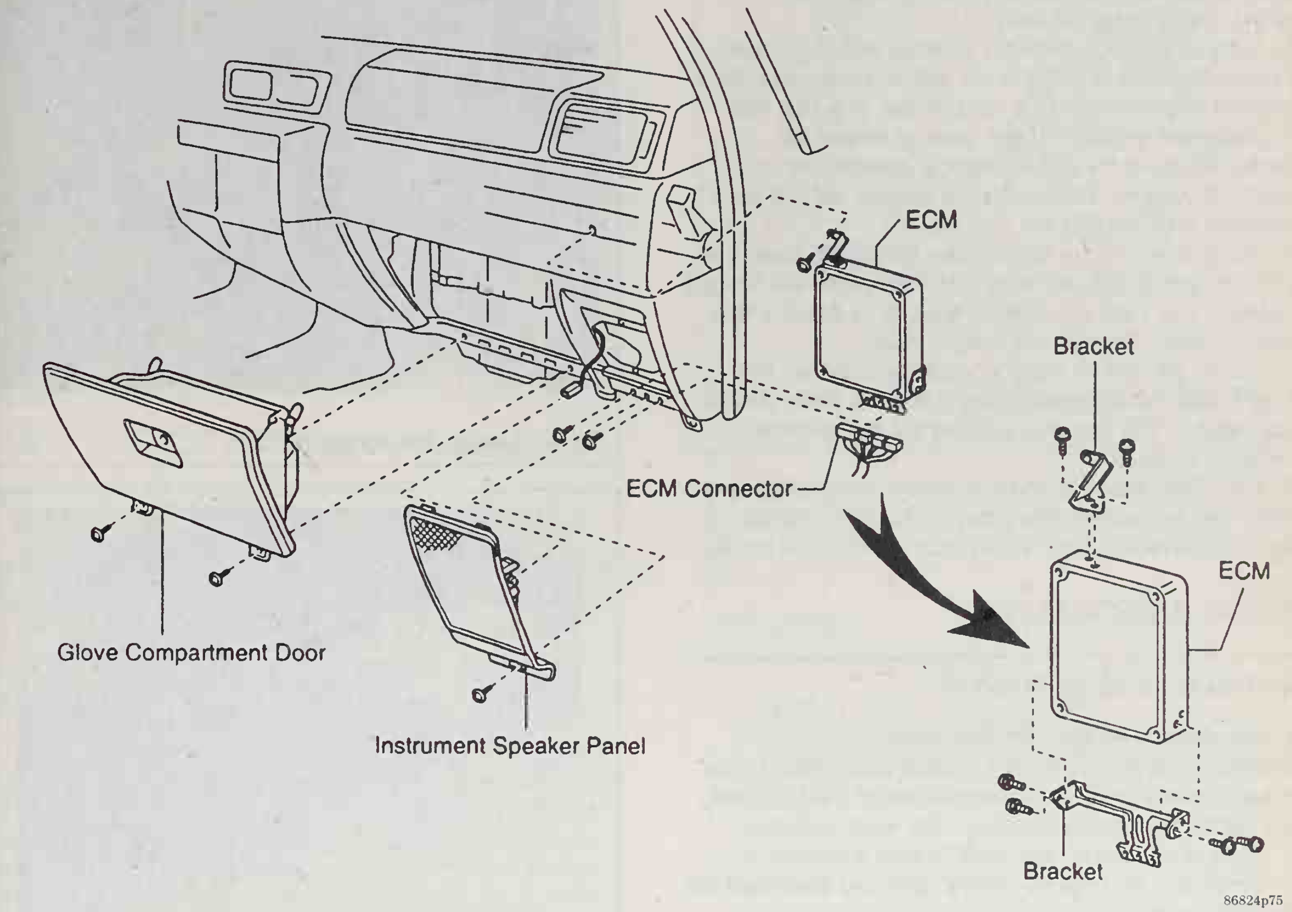

ECM
Bracket
ECM Connector
ECM
Glove Compartment Door
Instrument Speaker Panel
Bracket
86824p75

Fig. 51 The ECM is usually found behind the glove box — 1996 Land Cruiser shown

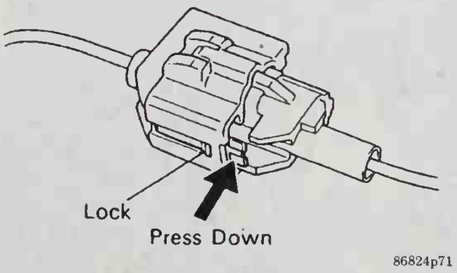

Lock
Press Down
86824p71

Fig. 52 Press down on the lock to release the connectors

OPERATION

The exhaust oxygen sensor or O2S, is mounted in the exhaust stream where it monitors oxygen content in the exhaust gas. The oxygen content in the exhaust is a measure of the air/fuel mixture going into the engine. The oxygen in the exhaust reacts with the oxygen sensor to produce a voltage which is read by the ECM.

TESTING

1. Start the engine and bring it to normal operating temperature, then run the engine above 1200 rpm for two minutes.
2. Backprobe with a high impedance averaging voltmeter (set to the DC voltage scale) between the oxygen sensor (02S) and battery ground.
3. Verify that the 02S voltage fluctuates rapidly between 0.40-0.60 volts.

4. If the 02S voltage is stabilized at the middle of the specified range (approximately 0.45-0.55 volts) or if the 02S voltage fluctuates very slowly between the specified range (02S signal crosses 0.5 volts less than 5 times in ten seconds), the 02S may be faulty.

5. If the 02S voltage stabilizes at either end of the specified range, the ECM is probably not able to compensate for a mechanical problem such as a vacuum leak or a high float level (carbureted engines). These types of mechanical problems will cause the 02S to sense a constant lean or constant rich mixture. The mechanical problem will first have to be repaired, then the 02S test repeated.

6. Pull a vacuum hose located after the throttle plate. Voltage should drop to approximately 0.12 volts (while still fluctuating rapidly). This tests the ability of the 02S to detect a lean mixture condition. Reattach the vacuum hose.

7. Richen the mixture using a propane enrichment tool. Voltage should rise to approximately 0.90 volts (while still fluctuating rapidly). This tests the ability of the 02S to detect a rich mixture condition.

8. If the 02S voltage is above or below the specified range, the 02S and/or the O2S wiring may be faulty. Check the wiring for any breaks, repair as necessary and repeat the test.

REMOVAL & INSTALLATION

See Figures 53, 54, 55, 56 and 57

1. Disconnect the negative battery cable.
2. Ensure that the engine and exhaust pipes are cold. Locate the oxygen sensor. Some sensors are on the front pipe others are on the catalyst, you may have more than one.
3. Spray a lubricant on the studs to ease removal.
4. Disconnect the negative battery cable and disconnect the oxygen sensor wiring.
5. Remove the oxygen sensor retaining nuts.
6. Remove the oxygen sensor and gasket.

To install:

7. Install the oxygen sensor with a new gasket.
8. Apply a coating of anti-seize to the studs. Install the nuts and tighten to 14 ft. lbs. (20 Nm).

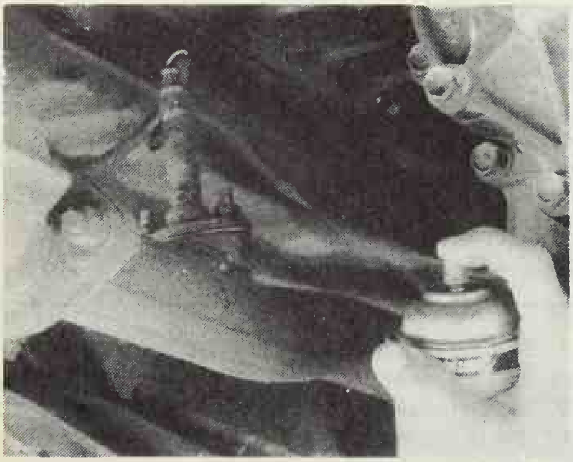

86824p87

Fig. 53 Use a penetrating lubricant to ease the removal of the mountng nuts

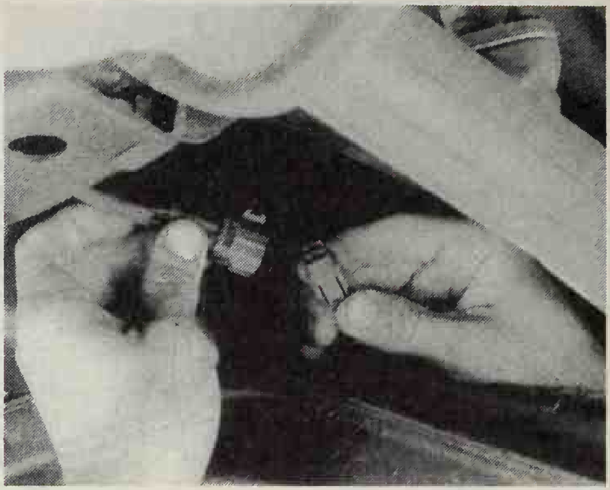

86824p85

Fig. 54 Unplug the sensor harness

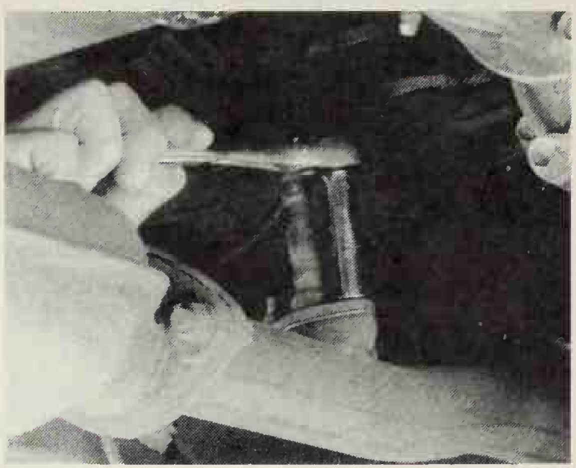

86824p86

Fig. 55 It may be necessary to use a deep socket to remove the mounting nuts

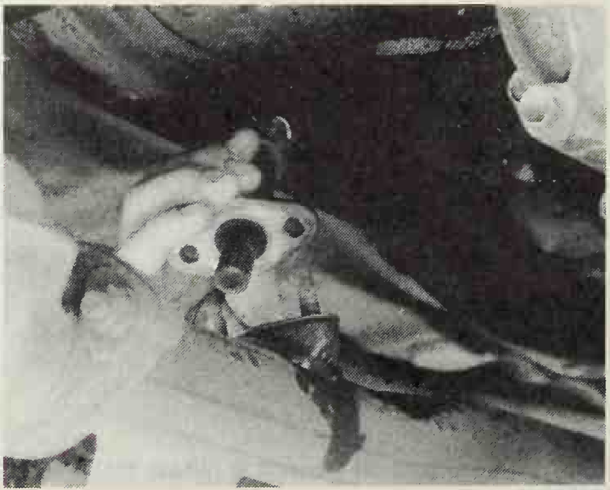
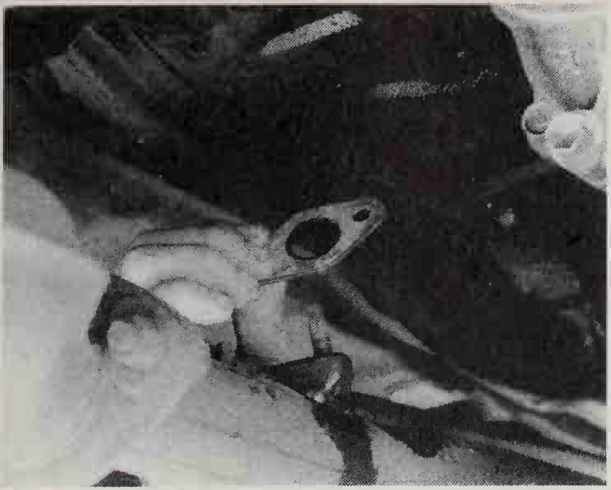

86824p88

Fig. 56 Remove the sensor . . .



86824p89

Fig. 57 . . . and the gasket

9. Connect the oxygen sensor wiring.
10. Connect the negative battery cable.

Idle Air Control (IAC) Valve

OPERATION

The purpose of the Idle Air Control (IAC) system is to control engine idle speed while preventing stalls due to changes in engine load. The IAC assembly, mounted on the throttle body, controls bypass air around the throttle plate. By extending or retracting a conical valve, a controlled amount of air can move around the throttle plate. If rpm is too low, more air is diverted around the throttle plate to increase rpm.

During idle, the proper position of the IAC valve is calculated by the ECM based on battery voltage, coolant temperature, engine load, and engine rpm. If the rpm drops below a specified rate, the throttle plate is closed. The ECM will then calculate a new valve position.

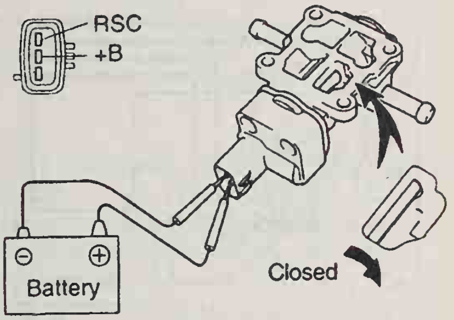
The IAC only affects the engine's idle characteristics. If it is stuck fully open, idle speed is too high (too much air enters the throttle bore) If it is stuck closed, idle speed is too low (not enough air entering). If it is stuck somewhere in the middle, idle may be rough, and the engine won't respond to load changes.

TESTING

➧ See Figures 58 and 59

Excluding 1FZ-FE Engine

1. Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC and RSO). It should read between 17.0-24.5 ohms.
2. Connect the positive lead from the battery to terminal +B and negative lead to RSC, then check that the valve is closed.



86824p81

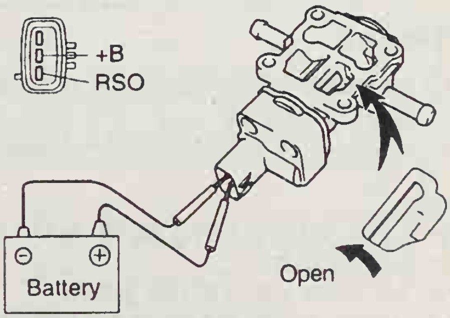
Fig. 58 With battery voltage applied as shown, the valve should be closed

3. Connect the positive lead from the battery to terminal +B and negative lead to RSO, then check that the valve is open.
4. If the valve did not perform as indicated, replace the IAC valve.

1FZ-FE Engine

➧ See Figures 60 and 61

1. Remove the IAC valve.
2. Apply battery voltage to terminals B1 and B2. Then, apply ground to terminals S1, S2, S3, S4 and S1 in sequence. Check that the valve moves towards the closed position.
3. Apply ground to terminals S4, S3, S2, S1 and S4 in sequence. Check that the valve moves towards the open position.
4. If the valve does not function as indicated, replace the IAC valve.
5. Install the IAC valve.



86824p82

Fig. 59 The valve should open when connected as shown

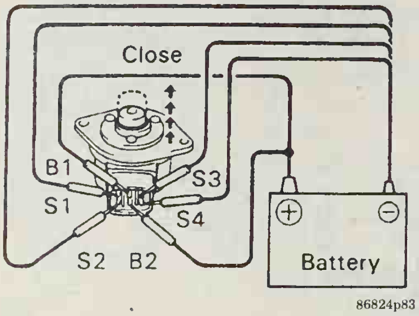


Fig. 60 The valve should close during the first sequence . . .

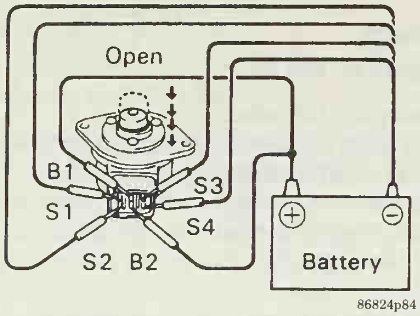


Fig. 61 . . . and open during the second

REMOVAL & INSTALLATION

➧ See Figure 62

1. Drain the coolant to a level below the throttle body.
2. Remove the throttle body.
3. Remove the screws and the IAC valve. Discard the old gasket or O-ring.

To install:

4. Using a new gasket or O-ring, attach the IAC valve and secure the mounting screws.
5. Install the throttle body with new gaskets.
6. Fill the cooling system with the proper water/coolant mixture.
7. Start the engine, top off the cooling system. Check for leaks.

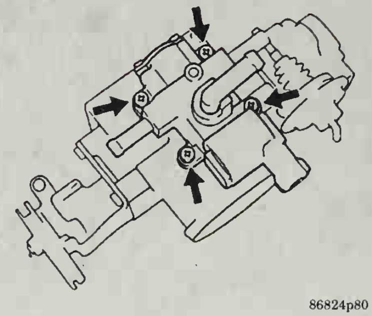


Fig. 62 Remove the screws mounting the valve to the throttle body

Engine Coolant Temperature (ECT) Sensor

OPERATION

The ECT is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. As the temperature of the engine coolant changes, the resistance of the coolant sensor changes. Low coolant temperature produces a high resistance: 100,000 ohms at -40°F (-40°C). High temperature causes low resistance: 70 ohms at 284°F (140°C).

The ECM supplies a 5 volt signal to the coolant sensor and measures the voltage that returns. By measuring the voltage change, the ECM determines the engine coolant temperature. The voltage will be high when the engine is cold and low when the engine is hot. This information is used to control fuel management, IAC, spark timing, EGR, canister purge and other engine operating conditions.

TESTING

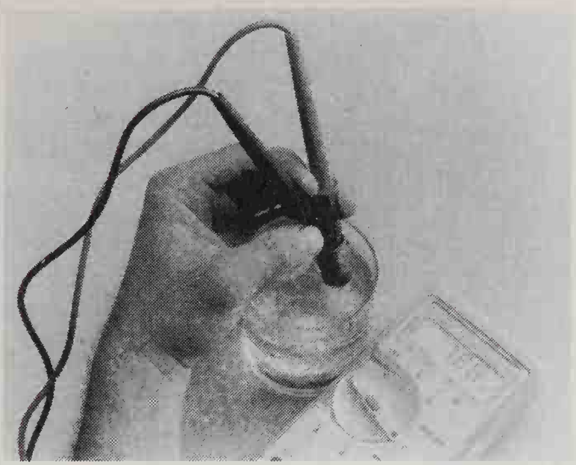
➧ See Figures 63 and 64

1. Remove the ECT sensor from the engine.
2. Fill a clean container with water and measure its temperature.
3. Place the sensor tip into the water. Measure the resistance of the ECT sensor with an ohmmeter. Compare the resistance with the temperature as per the graph.
4. If it is not within specifications, replace the sensor.
5. Install the ECT sensor.

REMOVAL & INSTALLATION

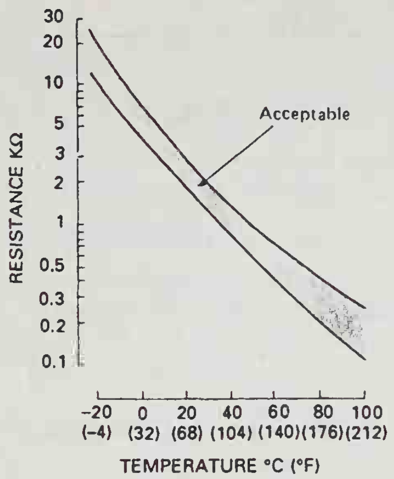
Excluding 5VZ-FE Engine

1. Drain the engine cooling system.



tccs4p02

Fig. 63 Submerge the end of the temperature sensor in cold or hot water and check resistance



86824p90

Fig. 64 Temperature sensor resistance graph

2. Disconnect the engine wire protector from the brackets if used.
3. Detach the ECT sensor wiring.
4. Using a deep socket, remove the ECT sensor and gasket.

To install:

5. Using a new gasket and deep socket, install the ECT sensor. Tighten to 14 ft. lbs. (20 Nm).
6. Connect the ECT wiring to the sensor.
7. Install the engine wire protector to the brackets if used.
8. Fill the cooling system, start the engine, top off the system.

5VZ-FE Engine

1. Drain the engine cooling system.
2. Disconnect the upper radiator hose from the water outlet.
3. Disconnect the power steering air hose from the clamp.
4. Disconnect the three cord clamps of the spark plug wires from the belt cover.
5. Remove the mounting bolts for the timing belt cover and gasket.
6. Disconnect the camshaft position sensor harness.
7. Remove the fuel pipe.
8. Disconnect the ECT sensor harness.
9. Using a 19mm deep socket, remove the sensor and gasket.

To install:

10. Using a new gasket and deep socket, install the ECT sensor. Tighten to 14 ft. lbs. (20 Nm).
11. Connect the ECT wiring to the sensor.
12. Reinstall the fuel pipe with four new gaskets, tighten to 25 ft. lbs. (34 Nm).
13. Attach the timing belt cover, tighten to 80 inch lbs. (9 Nm).
14. Reconnect the upper radiator hose to the water outlet.
15. Fill the cooling system, start the engine, top off. Check for leaks.

Intake Air Temperature (IAT) Sensor

OPERATION

The Intake Air Temperature (IAT) is a thermistor built into the air flow meter or is mounted on the air cleaner housing. A thermistor is a resistor which changes resistance value based intake air temperature. Low manifold air temperature produces a high resistance: 100,000 ohms at -40°F (-40°C). High temperature cause low resistance: 70 ohms at 284°F (140°C).

The ECM supplies a 5 volt signal to the IAT sensor through a resistor in the ECM and monitors the voltage. The voltage will be high when the manifold air is cold and low when the air is hot. By monitoring the voltage, the ECM calculates the air temperature and uses this data to help determine the fuel delivery and spark advance.

TESTING

▸ See Figures 63 and 64

1. With the IAT sensor exposed, measure the resistance between terminals E2 and THA of the air flow meter or the IAT sensor itself, with an ohmmeter. Check the ambient air temperature with a thermometer. Compare the resistance with the temperature as per the graph. Using a hair dryer, warm the air around the sensor and check the resistance once again.
2. If it sensor does not come within specifications, replace the sensor. If the sensor is contained inside the air flow meter, the entire unit must be replaced.

REMOVAL & INSTALLATION

➡This applies only for sensors mounted on the air cleaner housing.

1. Detach the electrical harness.
2. Unscrew the sensor and remove it from the housing.

To install:

3. Install the sensor into the housing.
4. Attach the harness.

Volume Air Flow (VAF) Meter

OPERATION

➡This component is used on 22R-E, 1FZ-FE, 3VZ-E and 3F-E engines.

This meter measures the amount of air flowing through the intake system. It is used by the ECM to calculate air/fuel mixture.

TESTING

22R-E, 1FZ-FE and 3VZ-E Engines

➧ See Figure 65

1. Disconnect the wiring from the VAF meter.
2. Using an ohmmeter, measure the resistance between terminals E2 and VS. Resistance should be as follows:
   - 22R-E — 200-400 ohms
   - 1FZ-FE and 3VZ-E — 200-600 ohms
3. If the test is not within specification, replace the unit.

3F-E Engines

➧ See Figure 66

1. Disconnect the wiring from the VAF meter.
2. Using an ohmmeter, measure the resistance between terminals E2 and VC.
3. The reading should be between 200-400 ohms.
4. If the test is not within specification, replace the unit.

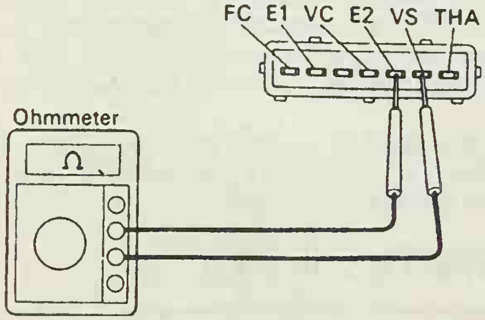


Fig. 65 Attach the ohmmeter to terminals E2 and VS

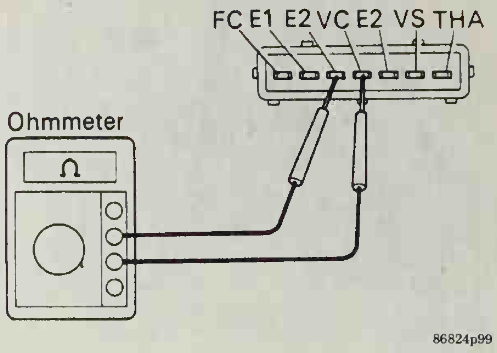


Fig. 66 Attach the ohmmeter to terminals E2 and VC on 3F-E engines

REMOVAL & INSTALLATION

22R-E Engine

➧ See Figures 67, 68, 69, 70 and 71

1. Disconnect the negative battery cable.
2. Disconnect the intake air connector.

➡You may need to disconnect nearby hoses.

3. Unplug the VAF meter connector. Remove the air cleaner cap with the VAF meter still attached.
4. Remove the retainer bolts, 4 nuts, washers, VAF meter and gasket from the air cleaner cap.

To install:

5. Attach the VAF meter with a new gasket to the air cleaner, then tighten until snug.
6. Connect the VAF meter wiring.
7. Install the intake air connector.
8. Connect the negative battery cable.
9. Start the engine and check for proper functions.

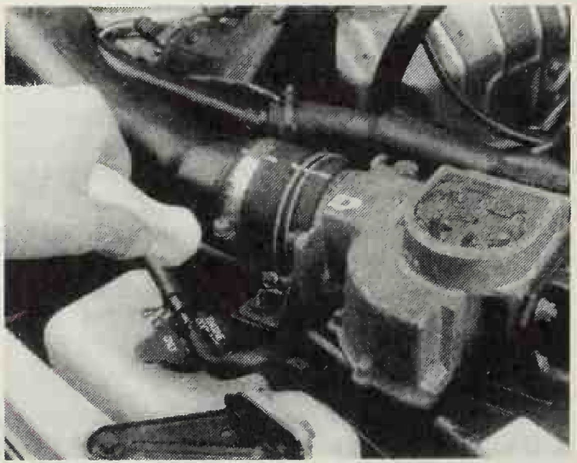
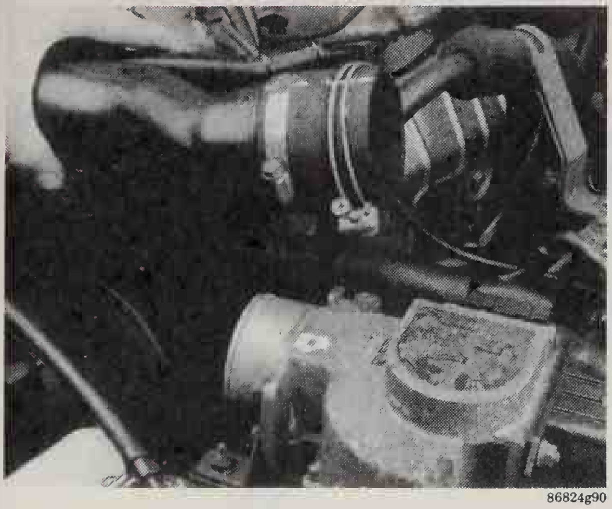
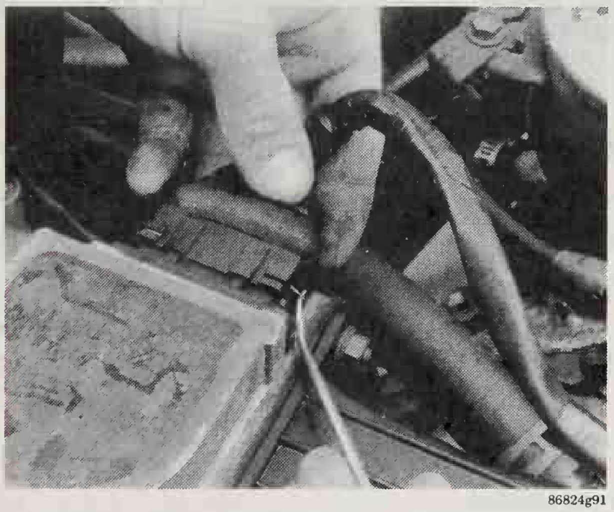


Fig. 67 Loosen the clamp surrounding the intake air hose



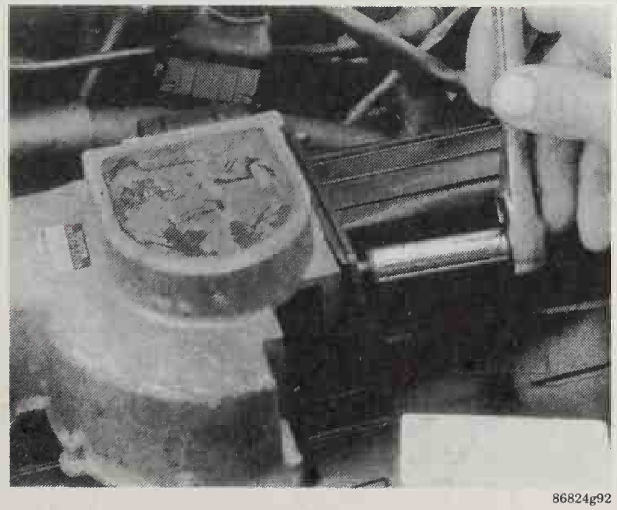
86824g90

Fig. 68 Slide the hose off of the sensor



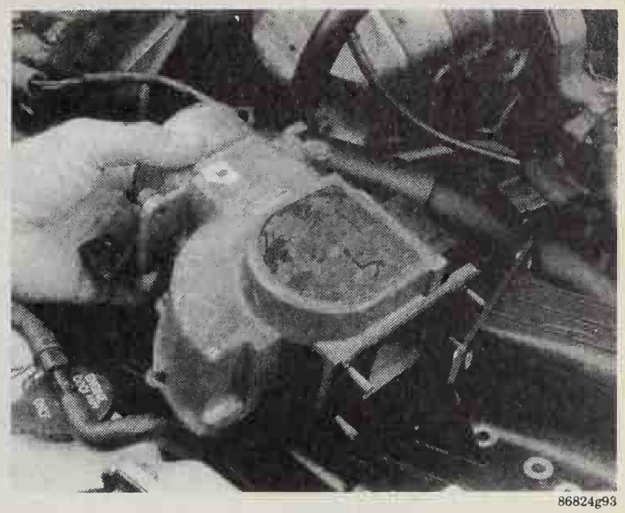
86824g91

Fig. 69 Detach the electrical harness from the sensor



86824g92

Fig. 70 Remove the mounting nuts and washers



86824g93

Fig. 71 Slip the unit from the air cleaner housing

1FZ-FE Engine

1. Disconnect the negative battery cable.
2. Disconnect the VAF meter electrical connector and wire clamp.
3. Disconnect the cruise control actuator cable.
4. Remove the air cleaner cap, VAF meter and silencer as follows:
    a. Disconnect the air cleaner hose from the VAF meter.
    b. Disconnect the air hose from the air suction reed valve.
    c. Disconnect the 3 clamps, remove the wing nut, air cleaner cap, VAF meter and silencer.
5. Remove the 4 nuts, plate washers, VAF meter, gasket and 4 collars. Remove the 2 screws, bolt and bolt bracket. Disconnect the VAF meter from the air cleaner cap.

To install:

6. Install the VAF meter to the air cleaner cap. Install the bracket to the VAF meter and tighten the fasteners to 43 inch lbs. (5 Nm). Place a new gasket and 4 collars on the VAF meter. Install the VAF meter to the air cleaner cap and tighten retainer nuts to 7 ft. lbs. (10 Nm).
7. Install the air cleaner cap to the air cleaner case with the 3 clips and wing nut. Connect the air hose to the air suction reed valve. Connect the air cleaner hose to the VAF meter.
8. Connect the cruise control actuator cable. Connect the VAF meter connector and wire clamp.
9. Connect the negative battery cable.

3VZ-E Engine

➧ See Figure 72

1. Disconnect the negative battery cable.
2. Disconnect the air hose and remove the 2 bolts from the resonator bracket. Disconnect the resonator bracket.
3. Disconnect the VAF meter connector. Disconnect the air cleaner hose connector.
4. Remove the air cleaner cap with the VAF meter assembly attached. Remove the retainers and the bracket from the meter assembly. Pry off the locking plate and and remove the 4 nuts, washers, lock plate, volume air flow meter and gasket.

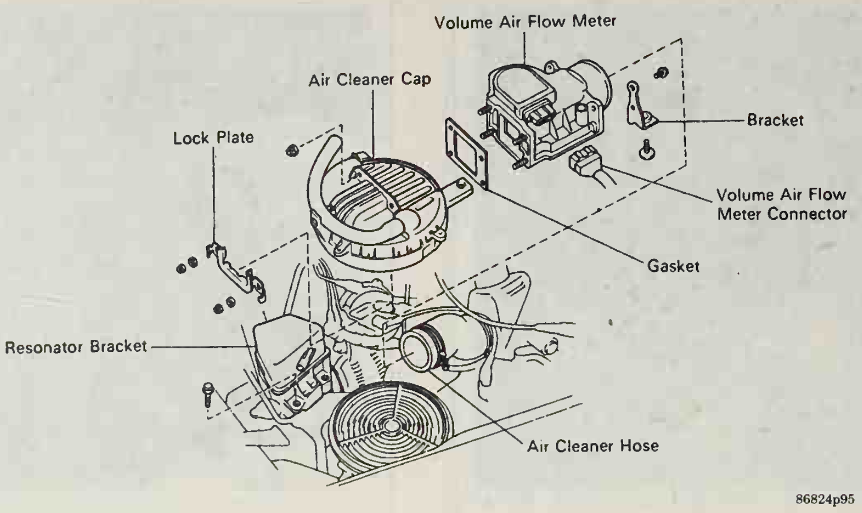


Fig. 72 Exploded view of the VAF meter on the 3VZ-E engine

To install:

5. Install the VAF meter to the air cleaner cap. Install the meter, new gasket, lock plate, washer and 4 nuts. Pry the locking plate on the nut and install the bracket.
6. Install the air cleaner cap and VAF meter assembly. Install the air cleaner hose.
7. Connect the VAF meter connection. Install the resonator bracket with the 2 bolts. Connect the air hose.
8. Connect the negative battery cable.

3F-E Engine

1. Disconnect the air flow meter wiring harness.
2. Remove the air cleaner hose.
3. Unbolt the air flow meter from the vehicle and discard the gasket.

To install:

4. Attach the air flow meter with a new gasket.
5. Connect the air cleaner hose.
6. Connect the air flow meter harness.

Mass Air Flow (MAF) Meter

OPERATION

➡This component is found on 2RZ-FE, 3RZ-FE, 5VZ-FE and 1FZ-FE engines.

This meter measures the amount of air flowing through the intake system. It is used by the ECM to calculate air/fuel mixture.

TESTING

➧ See Figure 73

1. Remove the air intake hose.
2. Turn the ignition switch to the **ON** position.
3. Using a voltmeter, attach the positive terminal probe to the terminal VG, and the negative probe to terminal E3.
4. Blow air into the MAF meter, then check that the voltage fluctuates.
5. Turn the ignition switch to the **OFF** position.
6. Install the air intake hose.

REMOVAL & INSTALLATION

2RZ-FE and 3RZ-FE Engines

➧ See Figure 74

1. Disconnect the MAF harness and the IAT harness along with the wire clamps.
2. Loosen the are cleaner hose clamp.
3. On the 3RZ-FE, disconnect the air hose from the air cleaner cap.
4. Loosen the four clips, then the air cleaner cap with the meter attached.
5. Remove the four nuts, MAF meter and gasket from the cap.
6. Discard the gasket.

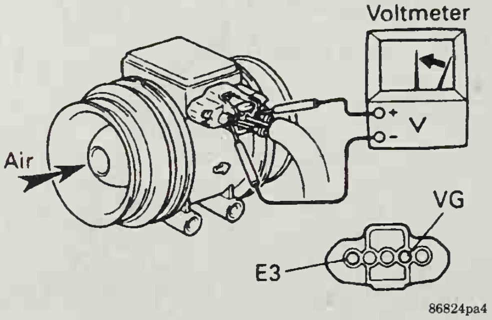


Fig. 73 Testing the E3 and VG circuits

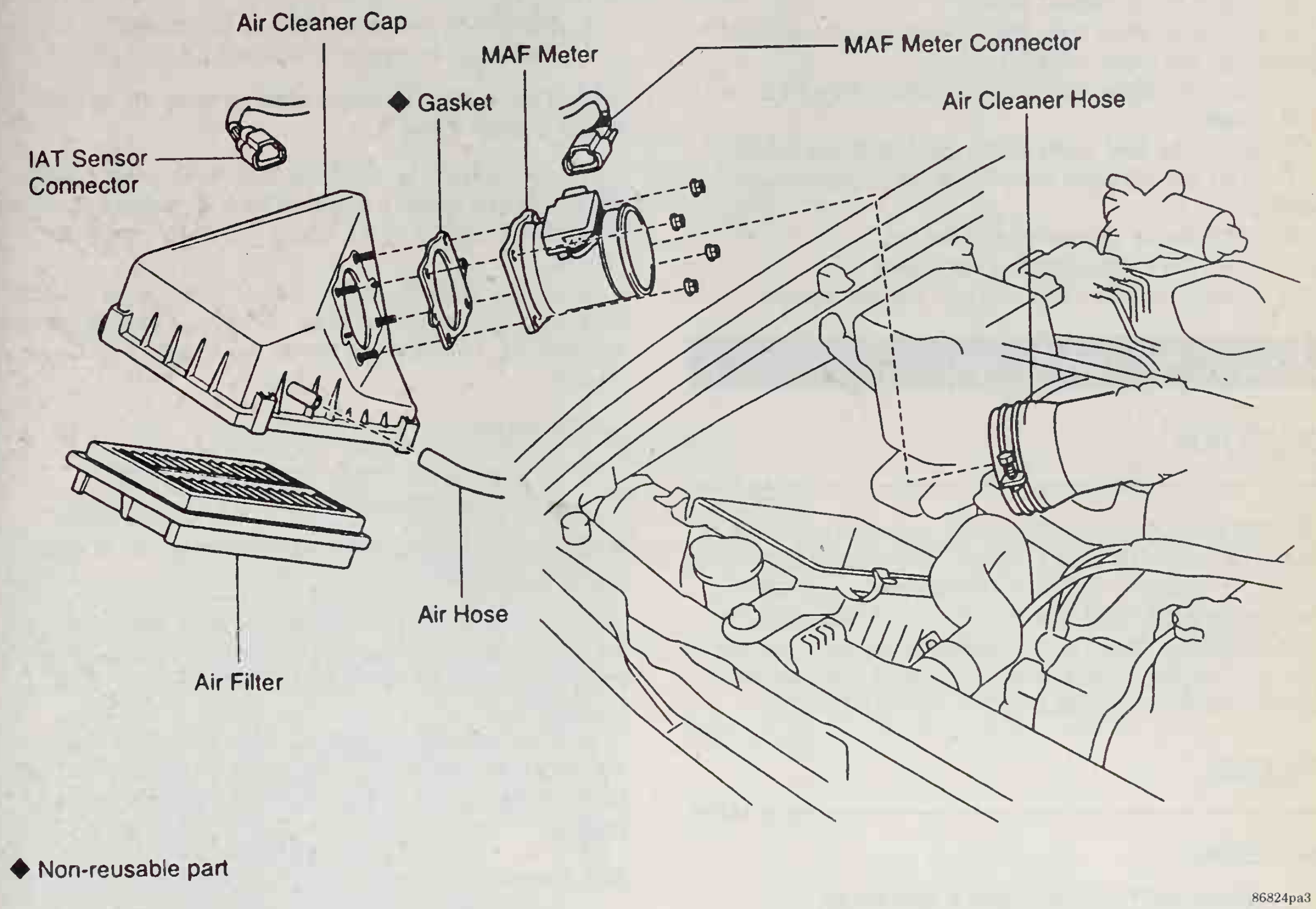

Air Cleaner Cap
MAF Meter
MAF Meter Connector
◆ Gasket
Air Cleaner Hose
IAT Sensor Connector
Air Hose
Air Filter
◆ Non-reusable part
86824pa3

Fig. 74 Exploded view of the MAF meter on the 2RZ-FE and 3RZ-FE engines

To install:

7. Place a new gasket on the air cleaner cap.
8. Install the MAF meter and tighten the nuts to 74 inch lbs. (8 Nm).
9. Install the meter and cap assembly on the air cleaner housing.

5VZ-FE Engine

➧ See Figure 75

1. Disconnect the air cleaner cap from the MAF meter.
2. Detach the harness from the meter.
3. Remove the mounting bolts for the meter. Lift off the meter and discard the gasket.

To install:

4. Place a new gasket in position, then tighten the meter to the cap assembly, 61 inch lbs. (7 Nm).
5. Attach the meter and cap assembly to the air cleaner housing.

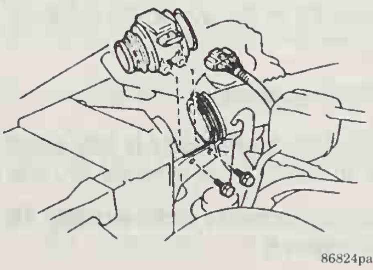


Fig. 75 Remove the bolts securing the meter

1FZ-FE Engine

1. Disconnect the MAF meter harness and wire clamps.
2. Separate the cruise control actuator cable from the unit.
3. Loosen the air cleaner hose.
4. Disconnect the 3 clips, then remove the wing nut, air cleaner cap and meter assembly.
5. Unbolt the meter from the cap. Discard the gasket.

To install:

6. Secure the MAF meter to the cap with a new gasket.
7. Install the cap/meter assembly to the air cleaner housing.
8. Attach the air cleaner hose to the unit.
9. Attach the cruise control actuator cable.
10. Connect the MAF meter harness and wire clamps.

Throttle Position Sensor

OPERATION

Throttle position sensors are usually mounted on the side of the throttle body. The sensor detects the throttle valve opening angle. The voltage of terminal VTA increases in proportion of the opening angle of the throttle valve. The ECM judges the driving conditions from the input signals of the terminals, and uses them as one of the conditions for deciding the air/fuel ratio correction, power increases and fuel cut-off control.

TESTING

22R-E Engine

1. Confirm that the throttle valve is fully closed.
2. Connect an ohmmeter to terminals IDL and E2.

➡E2 is the bottom terminal, while terminal IDL is positioned directly above it.

3. Insert a 0.0224 in. (0.57mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should be present.
4. Insert a 0.0335 in. (0.85mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. No continuity should be present.

3VZ-E and 1FZ-FE Engines

1. Confirm that the throttle valve is fully closed.
2. Connect an ohmmeter to terminals IDL and E2.

➡E2 is the bottom terminal, while terminal IDL is positioned directly above it.

3. Insert a 0.020 in. (0.50mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should be present.
4. Insert a 0.031 in. (0.80mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should not be present.

2RZ-FE and 3RZ-FE Engines

1. Confirm that the throttle valve is fully closed.
2. Connect an ohmmeter to terminals IDL and E2.

➡E2 is the bottom terminal, while terminal IDL is positioned directly above it.

3. Insert a 0.022 in. (0.57mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should be present.
4. Insert a 0.029 in. (0.74mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. No continuity should be present.

5VZ-FE Engine

1. Confirm that the throttle valve is fully closed.
2. Connect an ohmmeter to terminals IDL and E2.

➡E2 is the bottom terminal, while terminal IDL is positioned directly above it.

3. Insert a 0.013 in. (0.32mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should be present.
4. Insert a 0.021 in. (0.54mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. No continuity should be present.

3F-E Engine

1. Confirm that the throttle valve is fully closed.
2. Connect an ohmmeter to terminals IDL and E2.

➡E2 is the bottom terminal, while terminal IDL is positioned directly above it.

3. Insert a 0.0303 in. (0.77mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should be present.
4. Insert a 0.0429 in. (1.09mm) thick feeler gauge between the throttle stop screw and lever. Check for continuity between terminals IDL and E2 of the sensor. Continuity should not be present.

REMOVAL & INSTALLATION

➧ See Figures 76 and 77

1. Disconnect the negative battery cable.
2. Unplug the throttle position sensor electrical connector.
3. Loosen the sensor attaching screws and remove the sensor.

To install:

4. Make sure the tangs to the sensor are in good shape, not bent. Place the sensor on the the throttle body.
5. Attach the sensor mounting screws.

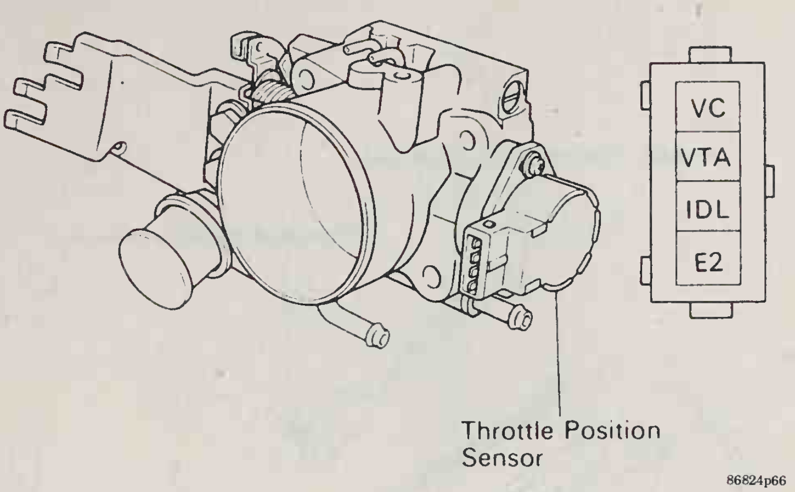


Fig. 76 Throttle position sensor location and terminal identification

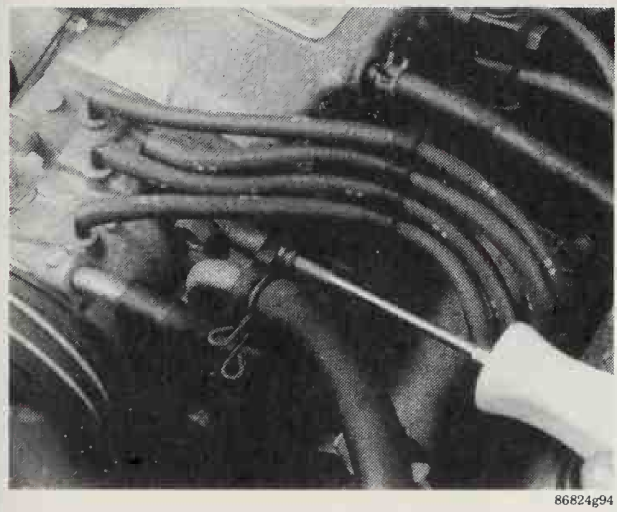


Fig. 77 The sensor is secured by screws

6. Connect the negative battery cable.
7. Start the engine and check for any problems.

Camshaft Position Sensor

OPERATION

The camshaft position sensor is installed on the front of the right cylinder head of the 5VZ-FE engine. The timing rotor has been integrated with the right bank camshaft timing pulley. While the camshaft rotates, the air gap between the protrusion on the timing rotor and the pick-up coil changes. This causes fluctuation in the magnetic field and generates a voltage signal in the pick-up coil.

TESTING

1. Disconnect the sensor harness.
2. Measure the resistance between the sensor terminals. It should be between 835-1400 ohms.
3. If not within specifications, replace the sensor.

REMOVAL & INSTALLATION

See Figure 78

1. Drain the engine cooling system.
2. Disconnect the upper radiator hose from the water outlet.
3. Disconnect the power steering air hose from the clamp.
4. Disconnect the three cord clamps of the spark plug wires from the belt cover.
5. Remove the mounting bolts for the timing belt cover and gasket.
6. Disconnect the camshaft position sensor harness.
7. Remove the sensor.

To install:

8. Attach the camshaft position sensor to the engine, tighten to 69 inch lbs. (8 Nm).
9. Attach the wiring harness to the sensor.
10. Install the timing belt cover tightening the six mounting bolts.
11. Attach the power steering pump hose to the belt cover clamp.
12. Install the spark plug wire clamps to the timing belt cover.
13. Attach the upper radiator hose.
14. Fill the cooling system, start the engine and top off the coolant.
15. Check for leaks.

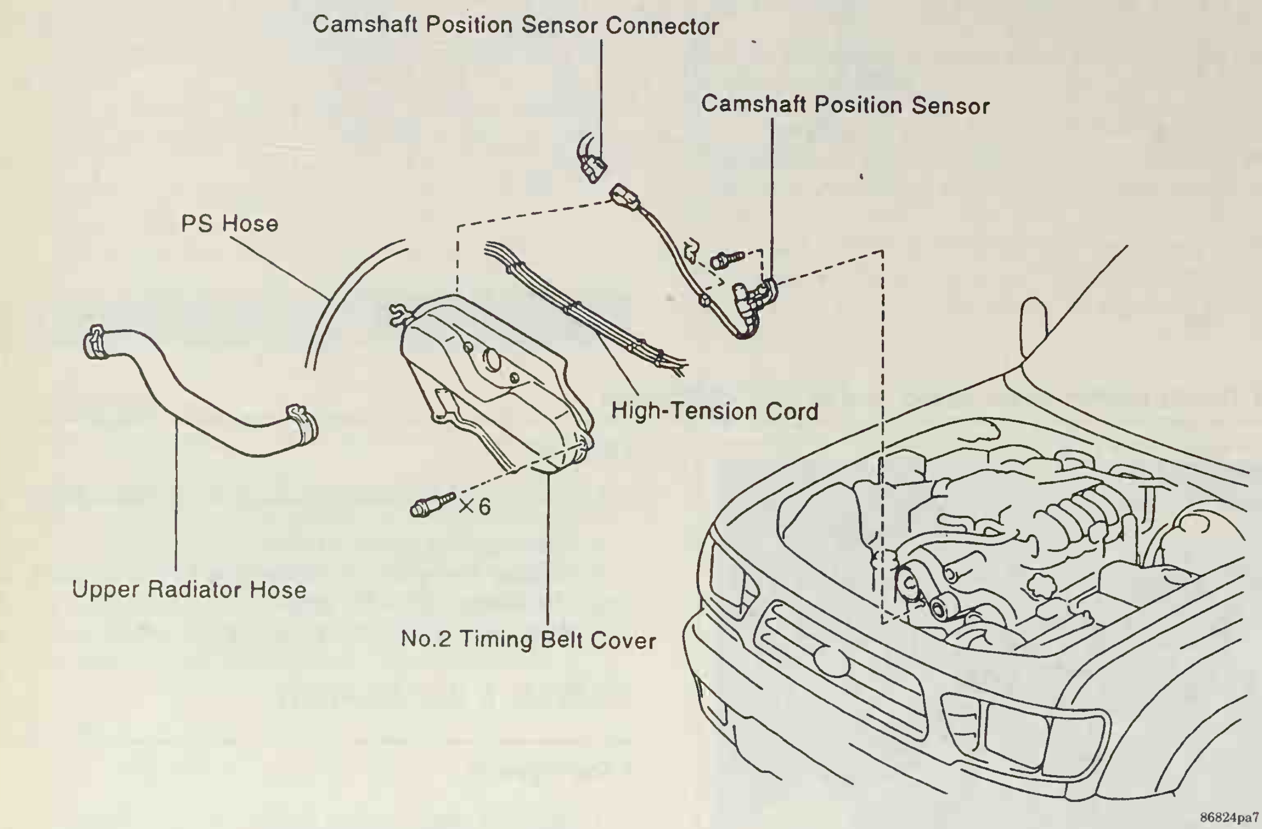

Camshaft Position Sensor Connector
Camshaft Position Sensor
PS Hose
High-Tension Cord
×6
Upper Radiator Hose
No.2 Timing Belt Cover
86824pa7

Fig. 78 Exploded view of the camshaft position sensor mounting

Crankshaft Position Sensor

OPERATION

This sensor is essentially a pick-up coil. While the crankshaft rotates, the air gap between the protrusion on the timing rotor and the pick-up coil changes. This causes fluctuation in the magnetic field and generates a varying voltage signal in the pick-up coil. It is used by the ECM to determine crankshaft angle and speed based upon the voltage received.

TESTING

1FZ-FE Engine

1. Unplug the sensor connector.
2. Measure the resistance between the sensor terminals. It should be between 240-325 ohms.
3. If not as specified, replace the sensor.

5VZ-FE, 2RZ-FE and 3RZ-FE Engines

1. Unplug the sensor connector.
2. Measure the resistance between the sensor terminals. It should be between 2065-3225 ohms.
3. If not as specified, replace the sensor.

REMOVAL & INSTALLATION

5VZ-FE Engine

See Figures 79 and 80

1. Disconnect the crankshaft position sensor harness.
2. Remove the bolt retaining the sensor to the vehicle.

To install:

3. Attach the sensor to the vehicle, tighten to 69 inch lbs. (8 Nm).
4. Attach the sensor harness.

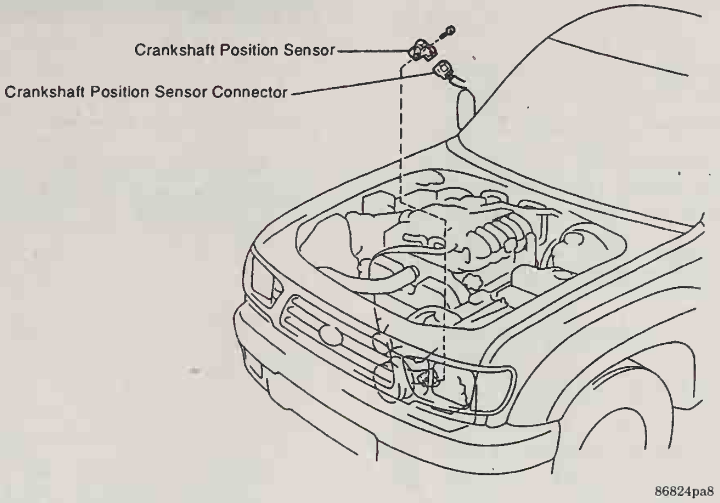

Crankshaft Position Sensor
Crankshaft Position Sensor Connector
86824pa8

Fig. 79 Exploded view of the crankshaft position sensor mounting

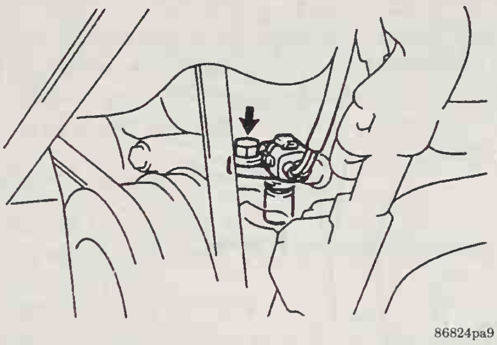


Fig. 80 The sensor is secured by a single bolt

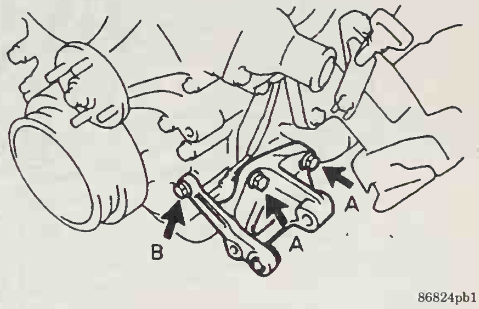


Fig. 81 Alternator bracket bolt identification

2VZ-FE and 3VZ-FE Engines

➧ See Figure 81

1. Remove the engine under cover.
2. Remove the alternator.
3. Unbolt the alternator bracket.
4. Disconnect the crankshaft position sensor harness.
5. Remove the bolts securing the sensor and the sensor. Discard the O-ring.

To install:

6. Apply a light coat of engine oil on the O-ring, install on the sensor.
7. Attach the sensor to the engine, tighten to 74 inch lbs. (9 Nm).
8. Attach the sensor harness.
9. Install the alternator bracket, tighten bolt (A) to 55 ft. lbs. (75 Nm) and bolt (B) to 13 ft. lbs. (18 Nm).
10. Install the alternator on the engine.
11. Install the engine under cover.

1FZ-FE Engine

➧ See Figure 82

1. Remove the engine under cover.
2. Unbolt the sensor protector.
3. Disconnect the crankshaft position sensor bracket and harness.
4. Remove the bolt, nuts and sensor.

To install:

5. Attach the sensor with the nuts and bolt. Tighten the bolt to 14 ft. lbs. (20 Nm) and the nuts to 78 inch lbs. (9 Nm).
6. Attach the bracket and harness.
7. Install the sensor protector, tighten the mounting bolts to 14 ft. lbs. (20 Nm).
8. Install the engine under cover.

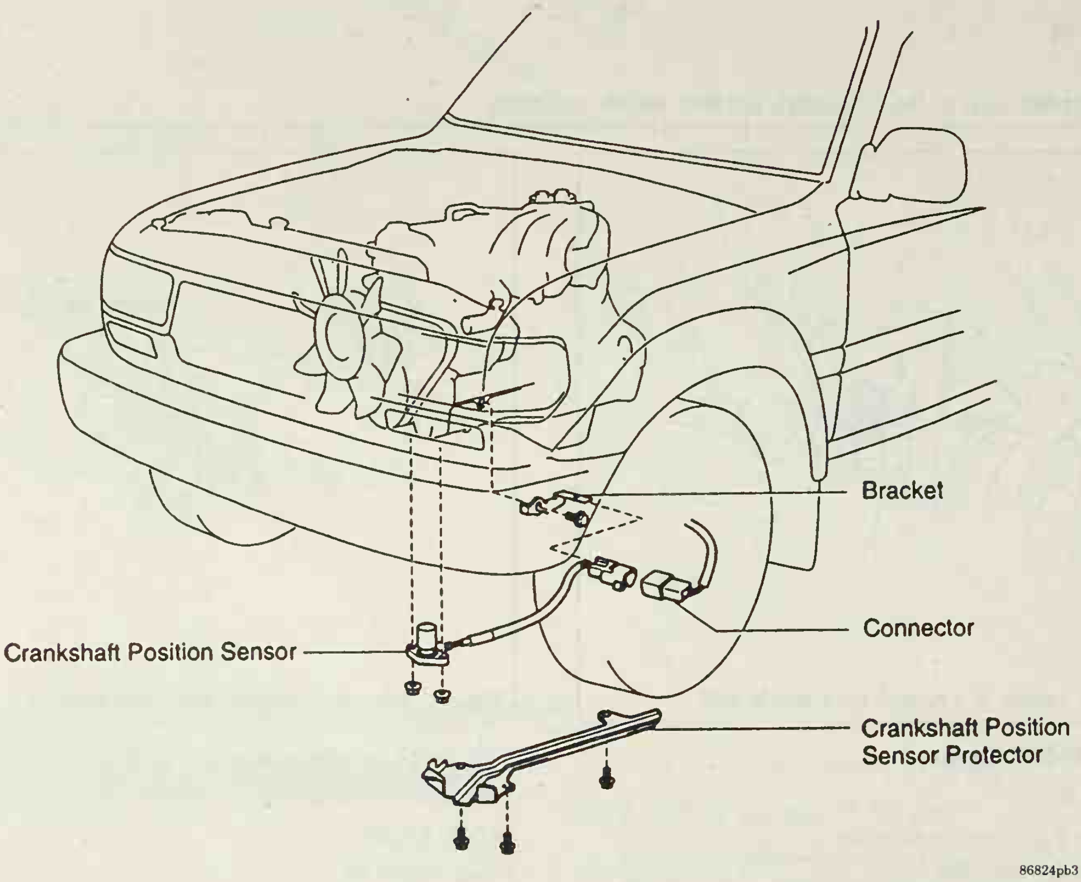

Bracket
Connector
Crankshaft Position Sensor
Crankshaft Position Sensor Protector
86824pb3

Fig. 82 Exploded view of the 1FZ-FE crankshaft position sensor mounting

Knock Sensor

OPERATION

Located in the engine block or cylinder head, the Knock Sensor (KS) retards ignition timing during a spark knock condition to allow the ECM to maintain maximum timing advance under most conditions.

TESTING

➧ See Figure 83

1. Remove the knock sensor(s).
2. Using an ohmmeter, check that there is no continuity between the terminal and the body. If there is continuity replace the sensor.

REMOVAL & INSTALLATION

➧ See Figure 84

➡A Toyota special tool or an equivalent socket, may be needed to remove and install the knock sensor. On the 2RZ-FE, 3RZ-FE and 1FZ-FE engines use SST 09816-30010. For the 5VZ-FE use SST 09817-16011.

Excluding 5VZ-FE Engines

1. Disconnect the sensor wire.
2. Remove the sensor with the aid of the appropriate SST tool or the equivalent.

To install:

3. Install the sensor, tighten to 33 ft. lbs. (44 Nm).
4. Attach the sensor wire.

5VZ-FE Engines

4RUNNER

1. Drain the engine cooling system.
2. Remove the air cleaner hose.
3. Remove the timing belt cover.
4. Remove the intake air connector.
5. Remove the fuel pressure regulator.
6. Remove the intake manifold.
7. Remove the water bypass pipe and knock sensor wire.
8. Using the appropriate SST or an equivalent, remove the two knock sensors.
9. Inspect the sensors.

To install:

10. Using the sensor tool, install the two sensors. Tighten to 29 ft. lbs. (39 Nm).
11. Attach the water bypass pipe and knock sensor wiring.
12. Install the fuel pressure regulator.
13. Install the intake air connector.
14. Attach the timing belt cover.
15. Attach the air cleaner hose.
16. Refill the engine cooling system.
17. Start the engine, top off the cooling system.

EXCLUDING 4RUNNER

1. Drain the engine cooling system.
2. Remove the air cleaner hose.
3. Remove the intake air connector.
4. Remove the spark plug wires and the ignition coils.
5. Unbolt the timing belt and camshaft idler pulleys.
6. Unbolt the timing belt idler.
7. Remove the fuel pressure regulator.
8. Remove the intake manifold assembly.
9. Unbolt and remove the water bypass pipe. Disconnect the knock sensor wire.
10. With the aid of the SST 09816-30010 or equivalent socket, remove the sensor(s).
11. Inspect the sensor(s) for continuity.

To install:

12. Install the sensor(s), tighten to 29 ft. lbs. (39 Nm).

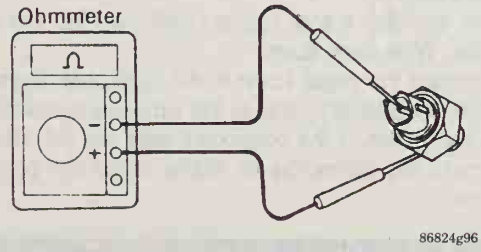


Fig. 83 Check for continuity with an ohmmeter

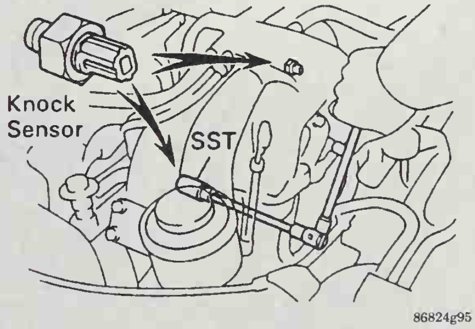


Fig. 84 Remove the sensor with the special tool or an equivalent deep socket

13. Reinstall the water bypass pipe and the knock sensor wires.
14. Attach the intake manifold assembly.
15. Install the fuel pressure regulator.
16. Install the timing belt idler.
17. Attach the camshaft timing pulleys and belt.
18. Install the ignition coils and wires.
19. Attach the intake air connector.
20. Attach the air cleaner hose.
21. Fill the cooling system.
22. Start the engine, top off the cooling system.

TROUBLE CODES

General Information

The ECM contains a built-in, self-diagnosis system which detects troubles within the engine signal network. Once a malfunction is detected, the Malfunction Indicator Lamp (MIL), located on the instrument panel, will light.

By analyzing various signals, the ECM detects system malfunctions related to the operating sensors. The ECM stores the failure code associated with the detected failure until the diagnosis system is cleared.

The MIL on the instrument panel informs the driver that a malfunction has been detected. The light will go out automatically once the malfunction has been cleared.

Data Link Connector (DLC)

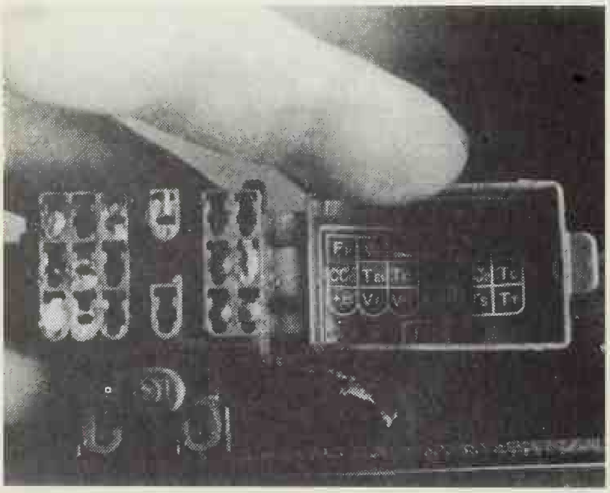
▸ See Figures 85, 86 and 87

The DLC1 is located in the engine compartment. The DLC3 is located in the interior of the vehicle, under the driver's side dash.

Reading Codes

1989-95 MODELS

1. Make sure the battery voltage is at least 11 volts.
2. Make sure the throttle valve is fully closed.



86824g88

Fig. 85 The DLC1 terminals are protected by a lid

3. Place the gear shift lever in Neutral. Turn all accessories off.
4. The engine should be at normal operating temperature.
5. Using a jumper wire, connect terminals TE1 and E1 of the Data Link Connector 1 (DLC1).
6. Turn the ignition switch **ON**, but do not start the engine. Read the diagnostic code by the counting the number of flashes of the malfunction indicator lamp.
7. Codes will flash in numerical order. If no faults are stored, the lamp flashes continuously every ½ second. This is sometimes called the Normal or System Clear signal.
8. After the diagnosis check, turn the ignition **OFF** and remove the jumper wire.
9. Compare the codes found to the applicable diagnostic code chart. If necessary, refer to the individual component tests in this section. If the component tests are OK, test the wire harness and connectors for shorts, opens and poor connections.

1996 MODELS

➡These models require the use of the Toyota's hand held scan tool or an equivalent OBD II compliant scan tool.

1. Prepare the scan tool according to the manufacturers instructions.
2. Connect the OBD II scan tool, to the DLC3 under the instrument panel.

➡When the diagnosis system is switched from the normal mode to the check mode, it erases all Diagnostic Trouble Codes (DTC) and freeze frame data recorded. Before switching modes, always check the DTC and freeze frame data and write them down.

3. Turn the ignition switch to the **ON** and switch the OBD II scan tool switch on.
4. Use the OBD II scan tool to check the DTC and freeze frame data. Write them down.
5. Compare the codes found to the applicable diagnostic code chart. If necessary, refer to the individual component tests in this section. If the component tests are OK, test the wire harness and connectors for shorts, opens and poor connections.

Clearing Trouble Codes

After repair of the circuit, the diagnostic code(s) must be removed from the ECM memory. With the ignition turned **OFF**, remove the 15 amp EFI fuse for 30 seconds or more. Once the time period has been observed, reinstall the fuse and check for normal code output.

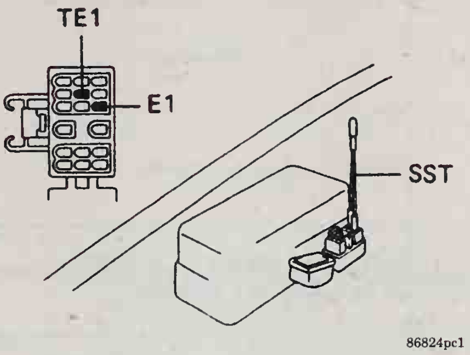


Fig. 86 The DLC1 is located in the engine compartment, on the side of the fuse block

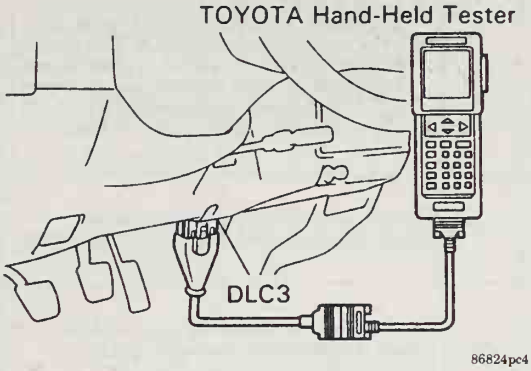


Fig. 87 The DLC3 is located under the dash

If the diagnostic code is not erased, it will be retained by the ECM and appear along with a new code in event of future trouble.

Cancellation of the trouble code can also be accomplished by disconnecting the negative battery cable. However, disconnecting the battery cable will erase the other memory systems including the clock and radio settings. If this method is used, always reset these components once the trouble code has been erased.

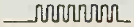
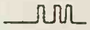
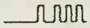
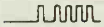
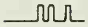
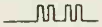
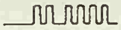
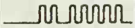
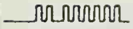
Code No.	Number of blinks Malfunction Indicator Lamp	System	MIL	Diagnosis	Trouble Area
–	 F11401	Normal	–	No trouble code is recorded.	————
12	 F11389	RPM Signal	ON	No NE signal is input to the ECM for 2 secs. or more after STA turns ON.	• Open or short in NE circuit • Distributor • Open or short in STA circuit • ECM
13	 F11390	RPM Signal	ON	NE signal is not input to ECM for 300 msec. or more when engine speed is 1,500 rpm or more.	• Open or short in NE circuit • Distributor • ECM
14	 F11391	Ignition Signal	ON	IGF signal from igniter is not input to ECM for 4 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECM • Igniter • ECM
21	 F11400	Main Oxygen Sensor Signal	ON	(1) Open or short in heater circuit of main oxygen sensor for 500 msec. or more. (HT) (2) At normal driving speed (below 60 mph and engine speed is above 1,700 rpm), amplitude of main oxygen sensor signal (OX1) is reduced to between 0.35–0.70 V continuously for 60 secs. or more.	• Open or short in heater circuit of main oxygen sensor • Main oxygen sensor heater • ECM • Open or short in main oxygen sensor circuit • Main oxygen sensor • ECM
22	 F11392	Engine Coolant Temp. Sensor Signal	ON	Open or short in engine coolant temp. sensor circuit for 500 msec. or more. (THW)	• Open or short in engine coolant temp. sensor circuit • Engine coolant temp. sensor • ECM
24	 F11611	Intake Air Temp. Sensor Signal	ON	Open or short in intake air temp. sensor circuit for 500 msec. or more. (THA)	• Open or short in intake air temp. circuit • Intake air temp. sensor • ECM
25	 F12562	Air-Fuel Ratio Lean Malfunction	ON	(1) Oxygen sensor output is less than 0.45 V for at least 90 secs. when oxygen sensor is warmed up (racing at 2,000 rpm). —Only for code 25. (2) When the air-fuel compensation value fluctuates more than 20% from the ECM set range within 60 secs. period while driving at 15 km/h (9 mph) or more at coolant temp. of 70°C (158°F) or above.	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in oxygen sensor circuit • Oxygen sensor • Ignition system • Engine coolant temp. sensor • Volume air flow meter (Air intake) • ECM
26	 F12563	Air-Fuel Ratio Rich Malfunction	ON		• Engine ground bolt loose • Open in E1 circuit • Short in injector circuit • Fuel line pressure (Injector leakage, etc.) • Open or short in cold start injector circuit • Cold start injector • Open or short in oxygen sensor circuit • Oxygen sensor • Engine coolant temp. sensor • Volume air flow meter • Compression pressure • ECM

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Fig. 88 Diagnostic Trouble Codes — 22R-E

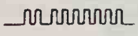
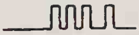
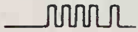
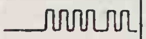
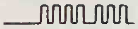
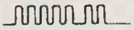
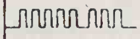
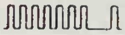
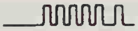
Code No.	Number of blinks Malfunction Indicator Lamp	System	MIL	Diagnosis	Trouble Area
27	 F13294	Sub-Oxygen Sensor Signal	ON	(1) When sub-oxygen sensor is warmed up and full acceleration continued for 2 seconds, output of main oxygen sensor is 0.45 V or more (rich) and output of sub-oxygen sensor is 0.45 V or less (lean). (OX2) (2) Open or short detected continuously for 500 msec. or more in sub-oxygen sensor heater circuit	• Short or open in sub-oxygen sensor circuit • Sub-oxygen sensor • Open or short in sub-oxygen sensor heater • ECM
31	 F11394	Volume Air Flow Meter Signal	ON	Open or short detected continuously for 500 msec. or more in volume air flow meter circuit • Open — VC or E2 • Short — VC−E2 or VS−VC	• Open or short in volume air flow meter circuit • Volume air flow meter • ECM
41	 F11396	Throttle Position Sensor Signal	ON	Open or short detected in throttle position sensor signal (VTA) for 500 msec. or more.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM
42	 F11397	Vehicle Speed Sensor Signal	OFF	SPD signal is not input to the ECM for at least 8 seconds during high load driving with engine speed between 2,200 rpm and 5,000 rpm.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECM
43	 F11398	Starter Signal	OFF	Starter signal (STA) is not input to ECM even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECM
52	 F11618	Knock Sensor Signal	ON	With engine speed 2,000 rpm or more signal from knock sensor is not input to ECM for 25 revolution. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECM
53	 F11619	Knock Control Signal	ON	The engine control computer (for knock control) malfunction is detected.	• ECM
71	 F12622	EGR System Malfunction	ON	With the coolant temp. at 65°C (149°F) or more, 50 seconds from start of EGR operation. The EGR gas temp. is less than 70°C (158°F) and the EGR gas temp. has risen less than 3°C during the 50 seconds.	• Open in EGR gas temp. sensor circuit • Open in VSV circuit for EGR • EGR vacuum hose disconnected, valve stuck • Cologged in EGR gas passage • ECM
51	 F11399	Switch Condition Signal	OFF	Displayed when IDL contact OFF or shift position in "R", "D", "2", or "1" ranges with the check terminals E1 and TE1 connected.	• Throttle position sensor IDL circuit • PNP switch circuit • Accelerator pedal, cable • ECM

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Fig. 89 Diagnostic Trouble Codes — 22R-E continued

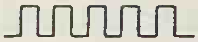
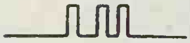
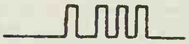
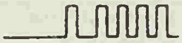
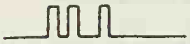
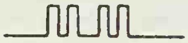
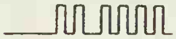
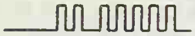
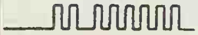
DTC No.	Number of Malfunction Indicator Lamp Blinks	System	Malfunction Indicator Lamp		Diagnosis	Trouble area
			Normal Mode	Test Mode		
—	 FI1604	Normal	—	—	No malfunctions detected.	—
12	 FI1606	RPM Signal	ON	N.A.	No "NE" or "G1", "G2" signal to ECM within 2 seconds after cranking the engine.	• Distributor circuit • Distributor • Starter signal circuit • ECM
13	 FI1607	RPM Signal	ON	ON	No "NE" signal is to ECM for 0.1 sec. or more when engine speed is above 1,000 rpm.	• Distributor circuit • Distributor • ECM
14	 FI1608	Ignition Signal	ON	N.A.	No "IGF" signal to ECM 6 times in succession, and no signal input within 256 msec.	• Igniter and ignition coil circuit • Igniter and ignition coil • ECM
21	 FI1609	No. 1 Heated Oxygen Sensor Signal	ON	ON	At normal driving speed (below 100 km/h and engine speed is above 1,700 rpm), amplitude of heated oxygen sensor signal (OX1) is reduced to between 0.35 — 0.70 V continuously for 60 seconds or more.	• Heated oxygen sensor circuit • Heated oxygen sensor • ECM
		No. 1 Heated Oxygen Sensor Heater Signal			Open or short circuit in heated oxygen sensor heater. (HT1)	• Heated oxygen sensor circuit • Heated oxygen sensor • ECM
22	 FI1610	Engine Coolant Temp. Sensor Signal	ON	ON	Open or short circuit in engine coolant temp. sensor signal for 0.5 sec. or more. (THW)	• ECT sensor circuit • ECT sensor • ECM
24	 FI1611	Intake Air Temp. Sensor Signal	ON	ON	Open or short circuit in intake air temp. sensor signal for 0.5 sec. or more. (THA)	• IAT sensor circuit • IAT sensor • ECM
25	 FI2562	Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Heated oxygen sensor output at 2,000 rpm is less than 0.45 V for at least 20 seconds when warmed up. Applies only to code 25 and for California models, excepting high-altitude areas. (2) When the engine speed varies by more than 15 rpm over the preceding crank angle period during a period of 20 seconds during idling with the intake air temp. 0°C (32°F) or above.	• Engine ground bolt loose • Open in E1 circuit • Injector circuit • Injector • Fuel line pressure • VAF meter • PAIR system • Heated oxygen sensor circuits • Heated oxygen sensors • Ignition system • ECM
26	 FI2563	Air-Fuel Ratio Rich Malfunction	ON	ON	(3) When the difference between the air-fuel ration feed back compensation value of the front and rear exceeds 15 % of the two values in a period of 20 seconds while the engine speed is 2,000 rpm or more and the engine coolant temp. is between 70°C (158°F) and 95°C (203°F).	• Engine ground bolt loose • Open in E1 circuit • Injector circuit • Injector • Fuel line pressure • ECT sensor • Compression pressure • ECM

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Fig. 90 Diagnostic Trouble Codes — 3F-E

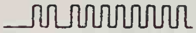
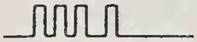
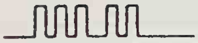
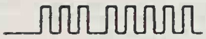
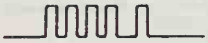
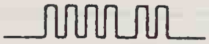
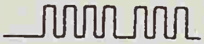
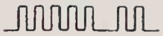
DTC No.	Number of Malfunction Indicator Lamp Blinks	System	Malfunction Indicator Lamp		Diagnosis	Trouble area
			Normal Mode	Test Mode		
28	 FI2698	No.2 Heated Oxygen Sensor Signal	ON	ON	At normal driving speed (below 100 km/h and engine speed is above 1,700 rpm), amplitude of heated oxygen sensor signal (OX2) is reduced to between 0.35 — 0.70 V continuously for 60 seconds or more.	• Heated oxygen sensor circuit • Heated oxygen sensor • ECM
		No.2 Heated Oxygen Sensor Heater Signal			Open or short circuit in heated oxygen sensor heater. (HT2)	• Heated oxygen sensor circuit • Heated oxygen sensor • ECM
31	 FI1612	Volume Air Flow Meter Signal	ON	ON	When idle contacts are closed and engine speed is 1,500 rpm or less, there is an open circuit in VC and VS signal or a short circuit between VS and E2.	• VAF meter circuit • VAF meter • ECM
32	 FI1613	Volume Air Flow Meter Signal	ON	ON	Open circuit in E2 or short circuit between VC and VS.	• VAF meter circuit • VAF meter • ECM
35	 FI2699	BARO Sensor Signal	ON	ON	Open or short circuit in BARO sensor signal for 60 seconds or more.	• ECM
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Open or short circuit in throttle position sensor signal.	• TP sensor circuit • TP sensor • ECM
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	No "SPD" signal for 8 seconds when engine speed 2,300 rpm or more and with vehicle not moving.	• Vehicle speed sensor circuit • Vehicle speed sensor • ECM
43	 FI1616	Starter Signal	N.A.	OFF	No "STA" signal to ECM until engine speed reaches 800 rpm with vehicle not moving.	• Ignition switch circuit • Ignition switch • ECM
52	 BE3935	No.1 Knock Sensor Signal (front side)	ON	N.A.	No No.1 knock sensor signal to ECM for 6 crank revolutions with engine speed between 1,600 rpm and 5,200 rpm.	• Open or short in No.1 knock sensor circuit. • No.1 knock sensor (looseness) • ECM

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Fig. 91 Diagnostic Trouble Codes — 3F-E continued

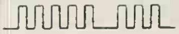
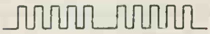
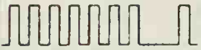
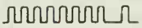
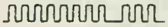
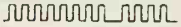
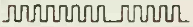
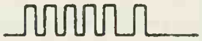
DTC No.	Number of Malfunction Indicator Lamp Blinks	System	Malfunction Indicator Lamp		Diagnosis	Trouble area
			Normal Mode	Test Mode		
53	 BE3935	Knock Control Signal	ON	N.A.	No knock control signal to ECM for 6 crank revolutions with engine speed between 1,800 rpm and 5,200 rpm.	• ECM
55	 BE3935	No.2 Knock Sensor Signal (rear side)	ON	N.A.	No No. 2 knock sensor signal to ECM for 6 crank revolutions with engine speed between 1,800 rpm and 5,200 rpm.	• Open or short in No.2 knock sensor circuit • No.2 knock sensor (looseness) • ECM
71	 FI2622	EGR System Malfunction	ON	ON	60 seconds after start of EGR operation, EGR gas temp. is less than 70°C (158°F) and the following (a)-(c) conditions also occurs: (a) Engine coolant temp.: 53°C (127°F) or more (b) Engine speed: 1,200 rpm or more (c) Intake air temp.: 0°C (32°F) or more	• EGR valve • EGR hose • EGR gas temp. sensor circuit • EGR gas temp. sensor • VSV for EGR • VSV circuit for EGR • ECM
81	 P09304	TCM Communication	ON	N.A.	Open in ECT1 circuit for 2 sec. or more.	• ECT1 circuit
83	 P09304	TCM Communication	ON	N.A.	Open in ESA1 circuit for 0.5 sec., after 0.5 sec. at idle.	• ESA1 circuit
84	 P09304	TCM Communication	ON	N.A.	Open in ESA2 circuit for 0.5 sec., after 0.5 sec. at idle.	• ESA2 circuit
85	 P09304	TCM Communication	ON	N.A.	Open in ESA3 circuit for 0.5 sec., ter 0.5 sec. at idle.	• ESA3 circuit
51	 FI1617	Switch Condition Signal	N.A.	OFF	No "IDL" signal, "NSW" signal or "A/C" signal to ECM, with the DLC1 terminals E1 and TE1 connected.	• A/C switch circuit • A/C switch • A/C amplifire • TP sensor IDL circuit • PNP switch circuit • PNP switch • Acceleration pedal and cable • ECM

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Fig. 92 Diagnostic Trouble Codes — 3F-E continued

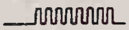
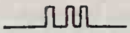
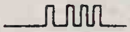
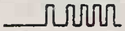
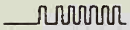
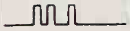
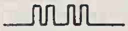
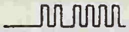
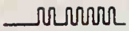
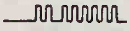
DTC No.	Number of blinks Malfunction Indicator Lamp	System	Malfunction Indicator Lamp		Diagnosis	Trouble Area
			Normal Mode	Test Mode		
–	 FI1401	Normal	–	–	Output when no other code is recorded.	
12	 FI1606	RPM Signal	ON	N.A.	No G or NE signal is input to the ECM for 2 secs. or more after STA turns ON.	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECM
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECM for 0.1 sec. or more when engine speed is 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECM
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECM for 6 consecutive ignitions.	• Open or short in IGF or IGT circuit from igniter to ECM • Igniter • ECM
16	 FI3600	A/T Control Signal	ON	N.A.	Normal signal is not output from ECU CPU.	• ECM
21	 FI1609	Heated Oxygen Sensor Signal	ON		(1) Open or short in heater circuit of heated oxygen sensor for 0.5 sec. or more. (HT) (2) At normal driving speed (below 60 mph and engine speed is above 1,500 rpm), amplitude of heated oxygen sensor signal (OX) is reduced to between 0.35 – 0.70 V continuously for 60 secs. or more.	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • ECM • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • ECM
22	 FI1610	Engine Coolant Temp. Sensor Signal	ON	ON	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more. (THW)	• Open or short in engine coolant temp. sensor circuit • Engine coolant temp. sensor • ECM
24	 FI1611	Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. circuit • Intake air temp. sensor • ECM
25	 FI2562	Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Heated oxygen sensor output is less than 0.45 V for at least 90 secs. When heated oxygen sensor is warmed up (racing at 2,000 rpm) and drive at 50 – 100 km/h	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Ignition system • Engine coolant temp. sensor • Volume air flow meter (Air intake) • ECM
26	 FI2563	Air-Fuel Ratio Rich Malfunction	ON	ON	(2) When the engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 seconds during idling with the engine coolant temp. 75°C (167°F) or more.	• Engine ground bolt loose • Open in E1 circuit • Short in injector circuit • Fuel line pressure (Injector leakage, etc.) • Open or short in cold start injector circuit • Cold start injector • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Engine coolant temp. sensor • Volume air flow meter • Compression pressure • ECM

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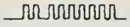
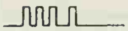
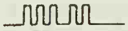
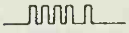
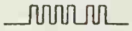
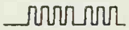
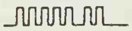
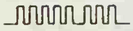
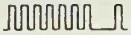
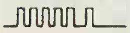
Fig. 93 Diagnostic Trouble Codes — 3VZ-E and 3RZ-FE

DTC No.	Number of blinks Malfunction Indicator Lamp	System	Malfunction Indicator Lamp		Diagnosis	Trouble Area
			Normal Mode	Test Mode		
27	 FI3294	Sub Heated Oxygen Sensor Signal	ON	ON	(1) Open or short in heater circuit of sub heated oxygen sensor for 0.5 sec. or more. (HT2) (2) When sub heated oxygen sensor is warmed up and full acceleration continued for 2 seconds, output of main heated oxygen sensor is 0.45 V or more (rich) and output of sub heated oxygen sensor is 0.45 V or less (lean). (OX2)	• Open or short in heater circuit of sub heated oxygen sensor circuit • Short or open in sub heated oxygen sensor circuit • Sub heated oxygen sensor • ECM
31	 FI1612	Volume Air Flow Meter Signal	ON	ON	At idling, open or short detected continuously for 0.5 sec. or more in volume air flow meter circuit. • Open – VC • Short – VC – E2	• Open or short in volume air flow meter circuit • Volume air flow meter • ECM
32	 FI1613	Volume Air Flow Meter Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in volume air flow meter circuit. • Open – E2 • Short – VS – VC	
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Open or short detected in throttle position sensor signal (VTA) for 0.5 sec. or more. IDL contact is ON and VTA output exceeds 1.45 V	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM
42	 FI1615	Vehicle Speed Sensor Signal	ON	OFF	SPD signal is not input to the ECM for at least 8 seconds during high load driving with engine speed between 2,750 rpm and 4,000 rpm.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECM
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECM even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECM
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1,600 rpm – 5,200 rpm, signal from knock sensor is not input to ECM for 6 revolution. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECM
53	 FI1619	Knock Control signal	ON	N.A.	Engine speed is between 650 rpm and 5,200 rpm and engine control module (for knock control) malfunction is detected.	• ECM
71	 FI2622	EGR System Malfunction	ON	ON	With the engine coolant temp at 60°C (140°F) or more, 240 seconds from start of EGR operation. The EGR gas temp. is less than 55°C (131°F) and the EGR gas temp. has risen less than 20°C (36°C) during the 240 seconds.	• Open in EGR gas temp. sensor circuit • Open in VSV circuit for EGR • EGR vacuum hose disconnected, valve stuck • Clogged in EGR gas passage • ECM
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "L" positions with the DLC1 terminals E1 and TE1 connected.	• A/C switch circuit • Throttle position sensor IDL circuit • Park/Neutral position switch circuit • Accelerator pedal, cable • ECM

86824c70

Fig. 94 Diagnostic Trouble Codes — 3VZ-E and 3RZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0100	Mass Air Flow Circuit Malfunction	Open or short in mass air flow meter circuit with engine speed 4,000 rpm or less
P0101	Mass Air Flow Circuit Range/Performance Problem	Conditions (a) and (b) continue with engine speed 900 rpm or less: (2 trip detection logic) (a) Closed throttle position switch: ON (b) Mass air flow meter output > 2.2 V
P0110	Intake Air Temp. Circuit Malfunction	Open or short in intake air temp. sensor circuit
P0115	Engine Coolant Temp. Circuit Malfunction	Open or short in engine coolant temp. sensor circuit
P0116	Engine Coolant Temp. Circuit Range/Performance Problem	20 min. or more after starting engine, engine coolant temp. sensor value is 32°C (90°F) or less
P0120	Throttle/Pedal Position Sensor/ Switch "A" Circuit Malfunction	Condition (a) or (b) continues: (a) VTA < 0.1 V, and closed throttle position switch is OFF (b) VTA > 4.9 V
P0121	Throttle/Pedal Position Sensor/ Switch "A" Circuit Range/ Performance Problem	When closed throttle position switch is ON, condition (a) continues: (2 trip detection logic) (a) VTA > 2.0 V
P0125	Insufficient Coolant Temp. for Closed Loop Fuel Control	After the engine is warmed up, heated oxygen sensor output does not indicate RICH even once when conditions (a), (b) and (c) continue for at least 1.5 minutes: (a) Engine speed: 1,500 rpm or more (b) Vehicle speed: 40 ~ 100 km/h (25 ~ 62 mph) (c) Closed throttle position switch: OFF
P0130	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	Voltage output of heated oxygen sensor remains at 0.4 V or more, or 0.55 V or less, during idling after the engine is warmed up
P0133	Heated Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	Response time for the heated oxygen sensor's voltage output to change from rich to lean, or from lean to rich, is 1 sec. or more during idling after the engine is warmed up

86824c60

Fig. 95 Diagnostic Trouble Codes — 2RZ-FE and 3RZ-FE

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0135	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	When the heater operates, heater current exceeds 2 A or voltage drop for the heater circuit exceeds 5 V
		Heater current of 0.25 A or less when the heater operates
P0136	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	Voltage output of the heated oxygen sensor (bank 1 sensor 2) remains at 0.4 V or more or 0.5 V or less when the vehicle is driven at 50 km/h (31 mph) or more after the engine is warmed up
P0141	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	Same as DTC No. P0135
P0170	Fuel Trim Malfunction	When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side or the LEAN side (2 trip detection logic)
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	After the engine is warmed up and run at 80 km/h (50 mph) for 3 to 5 minutes, small difference between value of EGR gas temp. sensor and ambient air temperature
P0402	Exhaust Gas Recirculation Flow Excessive Detected	EGR gas temp. sensor value is high during EGR cut-off when engine is cold and vacuum is applied to port E
		EGR valve is always open
P0420	Catalyst System Efficiency Below Threshold	After the engine is warmed up and the vehicle driven for 5 min. at 30 ~ 83 km/h (19 ~ 52 mph), the wave forms of the heated oxygen sensors, bank 1 sensor 1 and bank 1 sensor 2, have the same amplitude
P0441	Evaporative Emission Control System Incorrect Purge Flow	The proper response to the computer command does not occur

86824c61

Fig. 96 Diagnostic Trouble Codes — 2RZ-FE and 3RZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0500	Vehicle Speed Sensor Malfunction	No vehicle speed sensor signal to ECM under conditions (a): (a) Vehicle is being driven
P0505	Idle Control System Malfunction	Idle speed continues to vary greatly from the target speed
P0510	Closed Throttle Position Switch Malfunction	The closed throttle position switch does not turn ON even once when the vehicle is driven
P1300	Igniter Circuit Malfunction	No IGF signal to ECM for 4 consecutive IGT signals during engine running
P1335	Crankshaft Position Sensor Circuit Malfunction (during engine running)	No crankshaft position sensor signal to ECM with engine speed 1,000 rpm or more
P1500	Starter Signal Circuit Malfunction	No starter signal to ECM
P1600	ECM BATT Malfunction	Open in back up power source circuit
P1780	Park/Neutral Position Switch Malfunction	2 or more switches are ON simultaneously for ''N'', ''2'' and ''L'' position
		When driving under conditions (a) and (b) for 30 sec. or more the park/neutral position switch is ON (N position): (2 trip detection logic) (a) Vehicle speed: 70 km/h (44 mph) or more (b) Engine speed: 1,500 ~ 2,500 rpm

86824c62

Fig. 97 Diagnostic Trouble Codes — 2RZ-FE and 3RZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P1300	Igniter Circuit Malfunction	No IGF signal to ECM for 4 consecutive IGT signals during engine running
P1335	Crankshaft Position Sensor Circuit Malfunction (during engine running)	No crankshaft position sensor signal to ECM with engine speed 1,000 rpm or more
P1500	Starter Signal Circuit Malfunction	No starter signal to ECM
P1600	ECM BATT Malfunction	Open in back up power source circuit
P1780	Park/Neutral Position Switch Malfunction	2 or more switches are ON simultaneously for "N", "2" and "L" position (2 trip detection logic)
		When driving under conditions (a) and (b) for 30 sec. or more the park/neutral position switch is ON (N position): (2 trip detection logic) (a) Vehicle speed: 70 km/h (44 mph) or more (b) Engine speed: 1,500 ~ 2,500 rpm

86824c63

Fig. 98 Diagnostic Trouble Codes — 2RZ-FE and 3RZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0100	Mass Air Flow Circuit Malfunction	Open or short in mass air flow meter circuit with engine speed 4,000 rpm or less
P0101	Mass Air Flow Circuit Range/Performance Problem	Conditions (a) and (b) continue with engine speed 900 rpm or less: (a) Closed throttle position switch: ON (b) Mass air flow meter output > 2.2 V
P0110	Intake Air Temp. Circuit Malfunction	Open or short in intake air temp. sensor circuit
P0115	Engine Coolant Temp. Circuit Malfunction	Open or short in engine coolant temp. sensor circuit
P0116	Engine Coolant Temp.Circuit Range/Performance Problem	20 min. or more after starting engine, engine coolant temp. sensor value is 35°C (95°F) or less
P0120	Throttle/Pedal Position Sensor/Switch "A" Circuit Malfunction	Condition (a) or (b) continues: (a) VTA < 0.1 V, and closed throttle position switch is OFF (b) VTA > 4.9 V
P012[illegible]	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance Problem	When closed throttle position switch is ON, condition (a) continues: (a) VTA > 2.0 V
P0125	Insufficient Coolant Temp. for Closed Loop Fuel Control	After the engine is warmed up, heated oxygen sensor output does not indicate RICH even once when conditions (a), (b) and (c) continue for at least 1.5 minutes: (a) Engine speed: 1,500 rpm or more (b) Vehicle speed: 40 km/h (25 mph) or more (c) Closed throttle position switch: OFF

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Fig. 99 Diagnostic Trouble Codes — 5VZ-FE

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0133	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	Voltage output of heated oxygen sensor remains at 0.4 V or more, or 0.55V or less, during idling after the engine is warmed up
P0133	Heated Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	Response time for the heated oxygen sensor's voltage output to change from rich to lean, or from lean to rich, is 1 sec. or more during idling after the engine is warmed up
P0135	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	When the heater operates, heater current exceeds 2 A or voltage drop for the heater circuit exceeds 5 V
		Heater current of 0.25 A or less when the heater operates
P0136	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	Voltage output of the heated oxygen sensor (bank 1 sensor 2) remains at 0.4 V or more or 0.5 V or less when the vehicle is driven at 50 km/h (31 mph) or more after the engine is warmed up
P0141	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	Same as DTC No. P0135
P0170	Fuel Trim Malfunction	When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side or the LEAN side
P0300	Random/Multiple Cylinder Misfire Detected	Misfiring of random cylinders is detected during any particular 200 or 1,000 revolutions
P0301 **P0302** **P0303** **P0304** **P0305** **P0306**	Misfire Detected — Cylinder 1 — Cylinder 2 — Cylinder 3 — Cylinder 4 — Cylinder 5 — Cylinder 6	For any particular 200 revolutions of the engine, misfiring is detected which can cause catalyst overheating (This causes MIL to blink)
		For any particular 1,000 revolutions of the engine, misfiring is detected which cause a deterioration in emissions

86824c65

Fig. 100 Diagnostic Trouble Codes — 5VZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0325	Knock Sensor 1 Circuit Malfunction	No knock sensor 1 signal to ECM with engine speed 2,000 rpm or more
P0330	Knock Sensor 2 Circuit Malfunction	No knock sensor 2 signal to ECM with engine speed 2,000 rpm or more
P0335	Crankshaft Position Sensor "A" Circuit Malfunction	No crankshaft position sensor signal to ECM during cranking
		No crankshaft position sensor signal to ECM with engine speed 600 rpm or more
P0340	Camshaft Position Sensor Circuit Malfunction	No camshaft position sensor signal to ECM during cranking
		No camshaft position sensor signal to ECM during engine running
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	After the engine is warmed up and run at 80 km/h (50 mph) for 3 to 5 minutes, the EGR gas temperature sensor value does not exceed 60°C (140°F) above the ambient air temperature
P0402	Exhaust Gas Recirculaton Flow Excessive Detected	EGR gas temp. sensor value is high during EGR cut-off when engine is cold (Race engine at about 4,000 rpm without load so that vacuum is applied to port E)
		EGR valve is always open

86824c66

Fig. 101 Diagnostic Trouble Codes — 5VZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0420	Catalyst system Efficiency Below Threshold	After the engine is warmed up and the vehicle driven for 17 min. at 30 ~ 83 km/h (19 ~ 52 mph), the waveforms of the heated oxygen sensors, bank 1 sensor 1 and bank 1 sensor 2, have the same amplitude
P0441	Evaporative Emission Control System Incorrect Purge Flow	The proper response to the computer command does not occur
P0500	Vehicle Speed Sensor Malfunction	No vehicle speed sensor signal to ECM under conditions (a): (a) Vehicle is being driven
P050●	Idle Control System Malfunction	Idle speed continues to vary greatly from the target speed
P05●0	Closed Throttle Position Switch Malfunction	The closed throttle position switch does not turn ON even once when the vehicle is driven

86824c67

Fig. 102 Diagnostic Trouble Codes — 5VZ-FE continued

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P1300	Igniter Circuit Malfunction	No IGF signal to ECM for 6 consecutive IGT signals during engine running
P1335	Crankshaft Position Sensor Circuit Malfunction (during engine running)	No crankshaft position sensor signal to ECM with engine speed 1,000 rpm or more
P1500	Starter Signal Circuit Malfunction	No starter signal to ECM
P1600	ECM BATT Malfunction	Open in back up power source circuit
P1605	Knock Control CPU Malfunction	Engine control computer malfunction (for knock control)
P1780	Park/Neutral Position Switch Malfunction	Two or more switches are ON simultaneously for "N", "2" and "L" position
		When driving under conditions (a) and (b) for 30 sec. or more, the park/neutral position switch is ON (N position): (a) Vehicle speed: 70 km/h (44 mph) or more (b) Engine speed: 1,500 ~ 2,500 rpm

86824c68

Fig. 103 Diagnostic Trouble Codes — 5VZ-FE continued

DTC No.	Detection Item	Trouble Area
P0100	Mass Air Flow Circuit Malfunction	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM
P0101	Mass Air Flow Circuit Range/Performance Problem	• Mass air flow meter
P0110	Intake Air Temp. Circuit Malfunction	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECM
P0115	Engine Coolant Temp Circuit Malfunction	• Open or short in engine coolant temp. sensor circuit • Engine coolant temp. sensor • ECM
P0116	Engine Coolant Temp. Circuit Range/ Performance Problem	• Engine coolant temp. sensor • Cooling system
P0120	Throttle/Pedal Position Sensor/Switch "A" Circuit Malfunction	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/ Performance Problem	• Throttle position sensor
P0125	Insufficient Coolant Temp. for Closed Loop Fuel Control	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor
P0130	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Heated oxygen sensor • Fuel trim malfunction
P0133	Heated Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Heated oxygen sensor
P0135	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) (Bank 1 Sensor 2)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • ECM
P0136	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Heated oxygen sensor

86824ca1

Fig. 104 Diagnostic Trouble Codes — 1FZ-FE

DTC No.	Detection Item	Trouble Area
P0141	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	• Same as DTC No. P0135
P0171	System too Lean (Fuel Trim)	• Air intake (hose loose) • Fuel line pressure, leak • Injector blockage • Heated oxygen sensor malfunction • Mass air flow meter • Engine coolant temp. sensor
P0172	System too Rich (Fuel Trim)	• Fuel line pressure • Injector blockage, leak • Heated oxygen sensor malfunction • Mass air flow meter • Engine coolant temp. sensor
P0300	Random/Multiple Cylinder Misfire Detected	• Ignition system • Injector • Fuel line pressure • EGR • Compression pressure • Valve clearance not to specification • Valve timing • Mass air flow meter • Engine coolant temp. sensor
P0301 **P0302** **P0303** **P0304** **P0305** **P0306**	Misfire Detected — Cylinder 1 — Cylinder 2 — Cylinder 3 — Cylinder 4 — Cylinder 5 — Cylinder 6	
P0325	Knock Sensor 1 Circuit Malfunction	• Open or short in knock sensor 1 circuit • Knock sensor 1 (looseness) • ECM
P0330	Knock Sensor 2 Circuit Malfunction	• Open or short in knock sensor 2 circuit • Knock sensor 2 (looseness) • ECM
P0335	Crankshaft Position Sensor "A" Circuit Malfunction	• Open or short in crankshaft position sensor circuit for NE signal • Crankshaft position sensor for NE signal • Starter • ECM
P0340	Camshaft Position Sensor Circuit Malfunction	• Open or short in camshaft position sensor circuit • Camshaft position sensor • ECM
P0385	Crankshaft Position Sensor "B" Circuit Malfunction	• Open or short in crankshaft position sensor circuit for NE2 signal • Crankshaft position sensor for NE2 signal • ECM

86824ca2

Fig. 105 Diagnostic Trouble Codes — 1FZ-FE continued

DTC No.	Detection Item	Trouble Area
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	• EGR valve stuck closed • Short in VSV circuit for EGR • Open in EGR gas temp. sensor circuit • EGR hose disconnected • ECM
P0402	Exhaust Gas Recirculation Flow Excessive Detected	• EGR valve stuck open • EGR VSV open malfunction • Open in VSV circuit for EGR • Short in EGR gas temp. sensor circuit • ECM
P0420	Catalyst System Efficiency Below Threshold	• Three-way catalytic converter • Open or short in heated oxygen sensor circuit • Heated oxygen sensor
P0500	Vehicle Speed Sensor Malfunction	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • ECM
P0505	Idle Control System Malfunction	• IAC valve is stuck or closed • Open or short in IAC valve circuit • Open or short A/C signal circuit • Air intake (hose loose)
P0510	Closed Throttle Position Switch Malfunction	• Open in closed throttle position switch circuit • Closed throttle position switch • ECM

86824ca3

Fig. 106 Diagnostic Trouble Codes — 1FZ-FE continued

VACUUM DIAGRAMS

Following is a listing of vacuum diagrams for most of the engine and emissions package combinations covered by this manual. Because vacuum circuits will vary based on various engine and vehicle options, always refer first to the vehicle emission control information label, if present. Should the label be missing, or should vehicle be equipped with a different engine from the vehicle's original equipment, refer to the diagrams below for the same or similar configuration.

If you wish to obtain a replacement emissions label, most manufacturers make the labels available for purchase. The labels can usually be ordered from a local dealer.

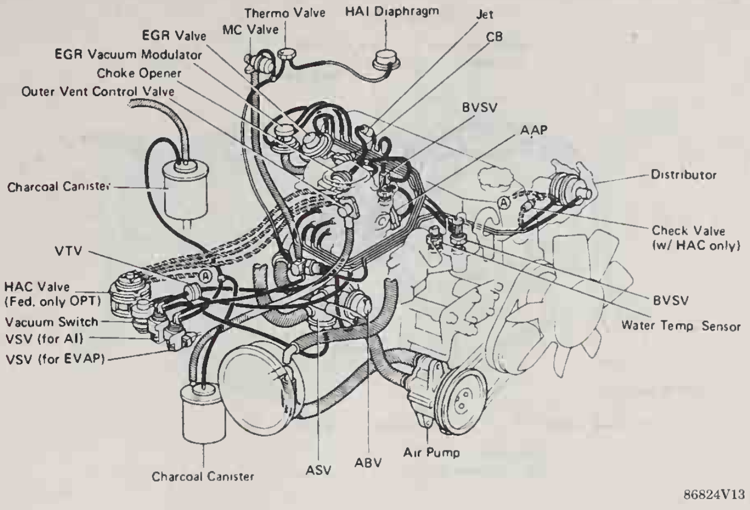

Thermo Valve
HAI Diaphragm
MC Valve
EGR Valve
Jet
CB
EGR Vacuum Modulator
Choke Opener
Outer Vent Control Valve
BVSV
AAP
Distributor
Charcoal Canister
Check Valve (w/ HAC only)
VTV
HAC Valve (Fed. only OPT)
Vacuum Switch
VSV (for AI)
VSV (for EVAP)
BVSV
Water Temp. Sensor
Air Pump
ABV
ASV
Charcoal Canister
86824V13

Fig. 107 Vacuum hose routing — 1989 22R (Federal and Canada)

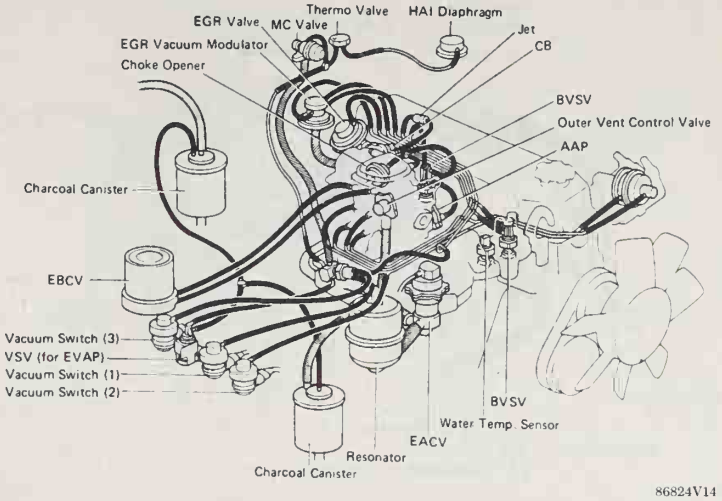

Thermo Valve
HAI Diaphragm
EGR Valve
MC Valve
Jet
EGR Vacuum Modulator
CB
Choke Opener
BVSV
Outer Vent Control Valve
AAP
Charcoal Canister
EBCV
Vacuum Switch (3)
VSV (for EVAP)
Vacuum Switch (1)
Vacuum Switch (2)
BVSV
Water Temp. Sensor
EACV
Resonator
Charcoal Canister
86824V14

Fig. 108 Vacuum hose routing — 1989 22R (California)

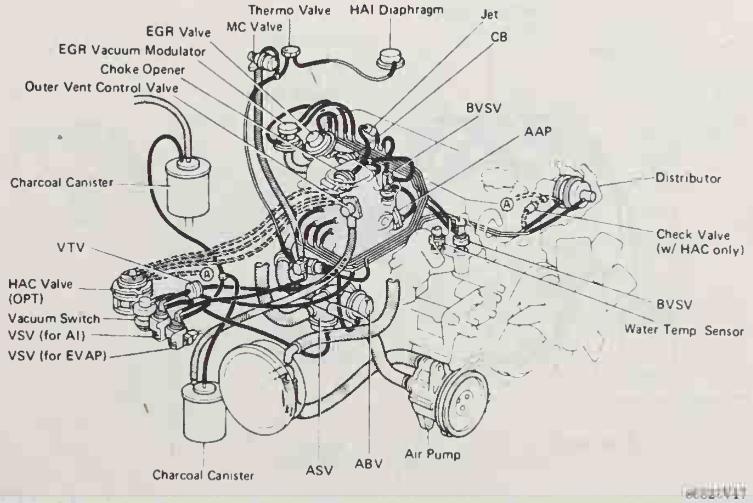

Thermo Valve
HAI Diaphragm
MC Valve
EGR Valve
Jet
CB
EGR Vacuum Modulator
Choke Opener
Outer Vent Control Valve
BVSV
AAP
Distributor
Charcoal Canister
Check Valve (w/ HAC only)
VTV
HAC Valve (OPT)
Vacuum Switch
VSV (for AI)
VSV (for EVAP)
BVSV
Water Temp. Sensor
Air Pump
ABV
ASV
Charcoal Canister
86824V17

Fig. 109 Vacuum hose routing — 1990 22R

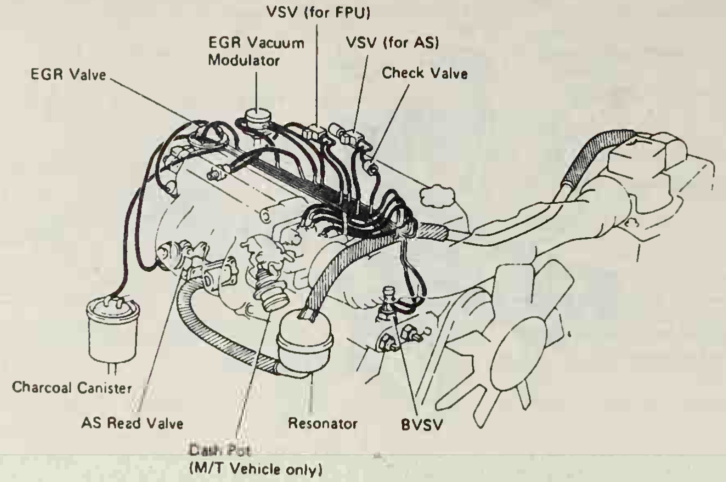

VSV (for FPU)
EGR Vacuum Modulator
VSV (for AS)
EGR Valve
Check Valve
Charcoal Canister
AS Reed Valve
Resonator
BVSV
Dash Pot (M/T Vehicle only)
86824V11

Fig. 110 Vacuum hose routing — 1989-90 22R-E (Federal and Canada)

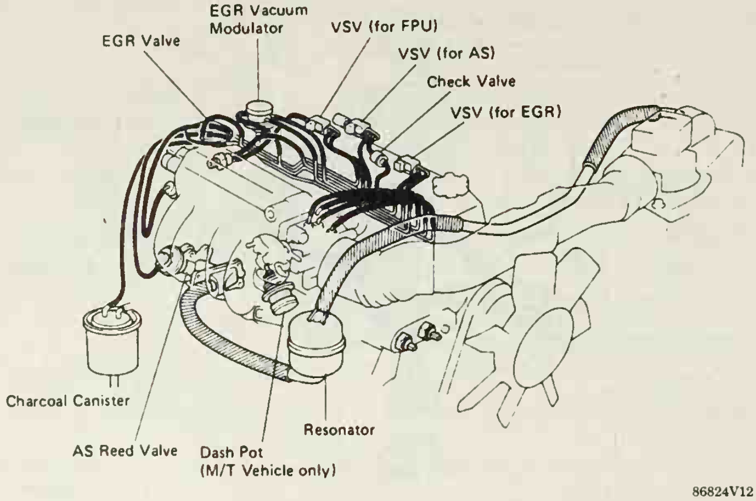

EGR Vacuum Modulator
EGR Valve
VSV (for FPU)
VSV (for AS)
Check Valve
VSV (for EGR)
Charcoal Canister
Resonator
AS Reed Valve
Dash Pot (M/T Vehicle only)
86824V12

Fig. 111 Vacuum hose routing — 1989-90 22R-E (California)

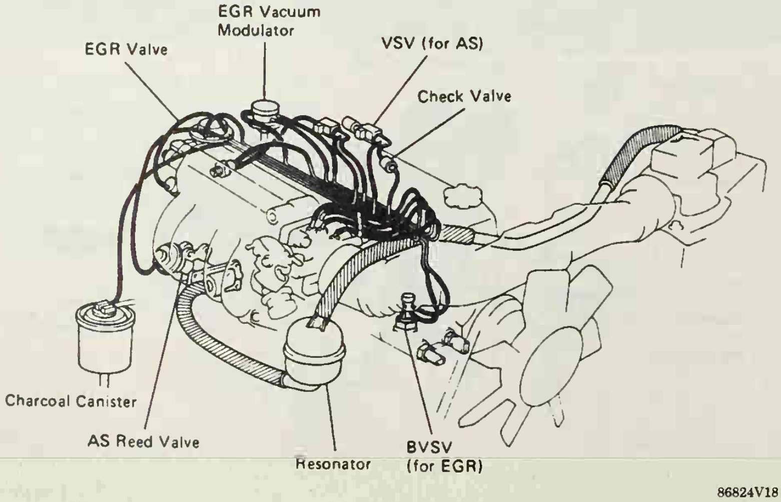

EGR Vacuum Modulator
EGR Valve
VSV (for AS)
Check Valve
Charcoal Canister
AS Reed Valve
Resonator
BVSV (for EGR)
86824V18

Fig. 112 Vacuum hose routing — 1991 22R-E (Federal and Canada)

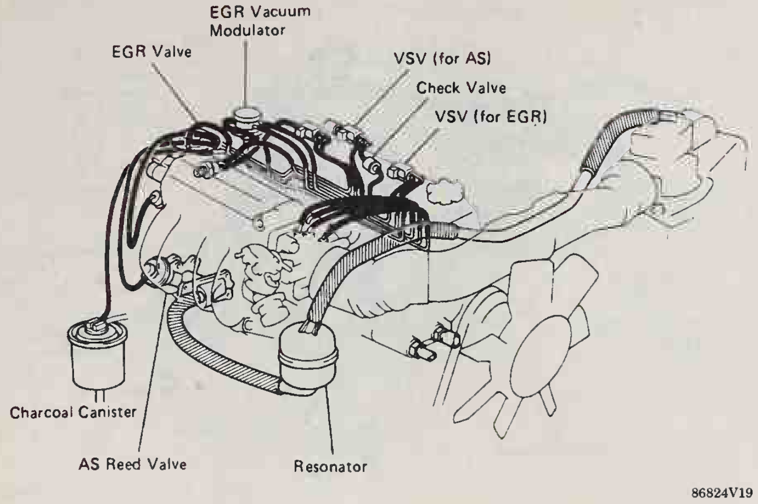

EGR Vacuum Modulator
EGR Valve
VSV (for AS)
Check Valve
VSV (for EGR)
Charcoal Canister
AS Reed Valve
Resonator
86824V19

Fig. 113 Vacuum hose routing — 1991-95 22R-E (California)

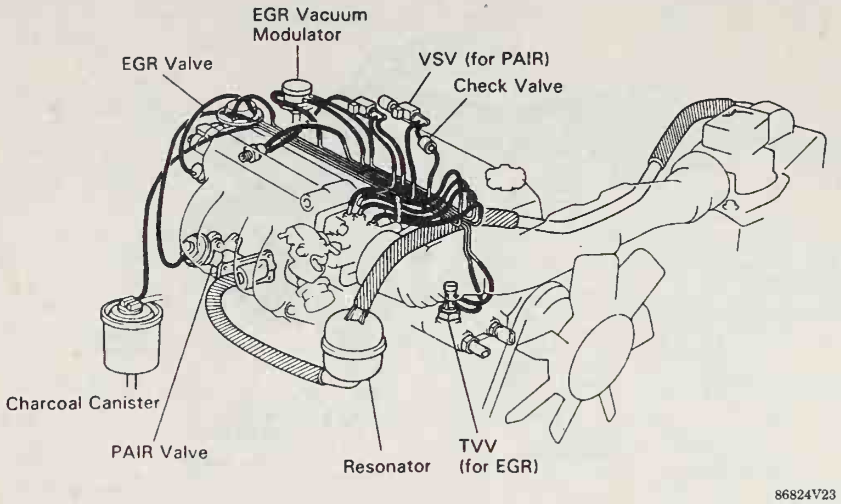

EGR Vacuum Modulator
EGR Valve
VSV (for PAIR)
Check Valve
Charcoal Canister
PAIR Valve
Resonator
TVV (for EGR)
86824V23

Fig. 114 Vacuum hose routing — 1992-95 22R-E (Federal and Canada)

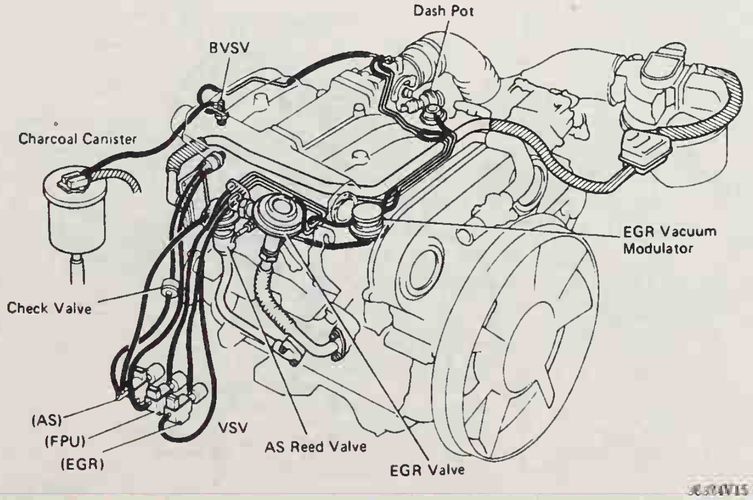
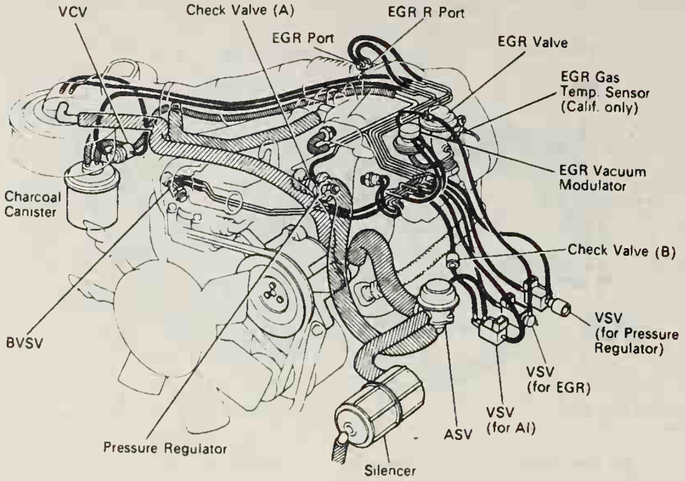
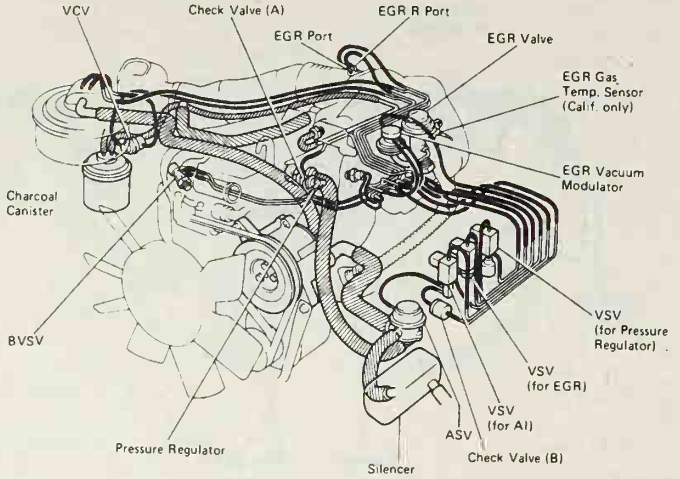

Dash Pot
BVSV
Charcoal Canister
EGR Vacuum Modulator
Check Valve
(AS)
(FPU)
(EGR)
VSV
AS Reed Valve
EGR Valve
86824V15

Fig. 115 Vacuum hose routing — 1989-93 3VZ-E


VCV
Check Valve (A)
EGR R Port
EGR Port
EGR Valve
EGR Gas Temp. Sensor (Calif. only)
EGR Vacuum Modulator
Charcoal Canister
Check Valve (B)
VSV (for Pressure Regulator)
BVSV
VSV (for EGR)
VSV (for AI)
ASV
Pressure Regulator
Silencer

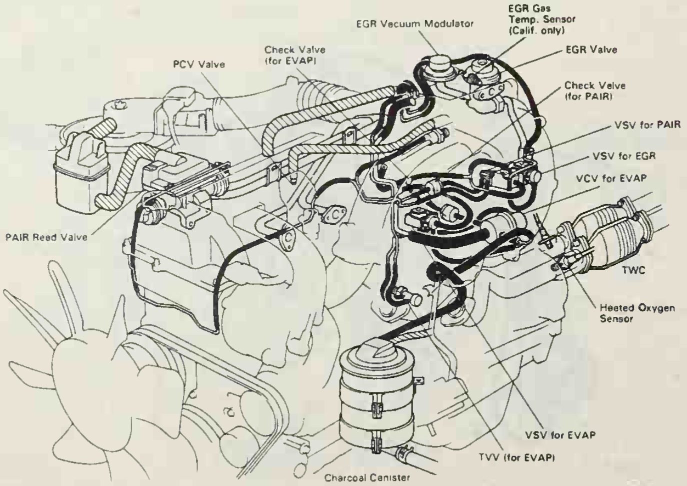
86824V16

Fig. 116 Vacuum hose routing — 1989-90 3F-E


VCV
Check Valve (A)
EGR R Port
EGR Port
EGR Valve
EGR Gas Temp. Sensor (Calif. only)
EGR Vacuum Modulator
Charcoal Canister
BVSV
VSV (for Pressure Regulator)
VSV (for EGR)
VSV (for AI)
ASV
Pressure Regulator
Check Valve (B)
Silencer

86824V20

Fig. 117 Vacuum hose routing — 1991-92 3F-E


EGR Gas Temp. Sensor (Calif. only)
EGR Vacuum Modulator
EGR Valve
Check Valve (for EVAP)
PCV Valve
Check Valve (for PAIR)
VSV for PAIR
VSV for EGR
VCV for EVAP
PAIR Reed Valve
TWC
Heated Oxygen Sensor
VSV for EVAP
TVV (for EVAP)
Charcoal Canister

8 24V26

Fig. 118 Vacuum hose routing — 1993-95 1FZ-FE

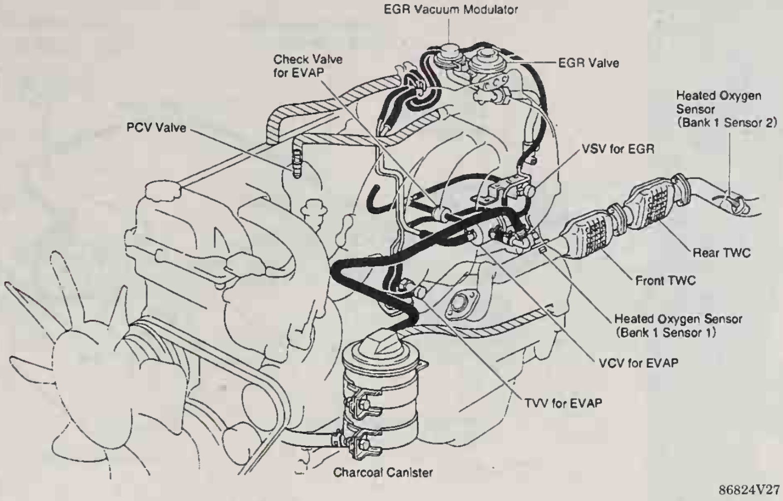

EGR Vacuum Modulator
Check Valve for EVAP
EGR Valve
PCV Valve
Heated Oxygen Sensor (Bank 1 Sensor 2)
VSV for EGR
Rear TWC
Front TWC
Heated Oxygen Sensor (Bank 1 Sensor 1)
VCV for EVAP
TVV for EVAP
Charcoal Canister
86824V27

Fig. 119 Vacuum hose routing — 1996 1FZ-FE

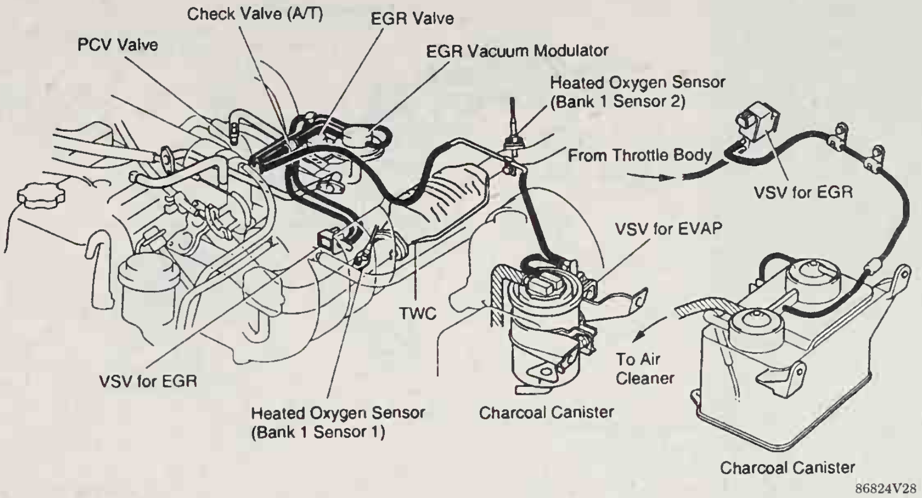

Check Valve (A/T)
EGR Valve
PCV Valve
EGR Vacuum Modulator
Heated Oxygen Sensor (Bank 1 Sensor 2)
From Throttle Body
VSV for EGR
VSV for EVAP
TWC
To Air Cleaner
VSV for EGR
Heated Oxygen Sensor (Bank 1 Sensor 1)
Charcoal Canister
Charcoal Canister
86824V28

Fig. 120 Vacuum hose routing — 1994-95 2RZ-FE and 3RZ-FE

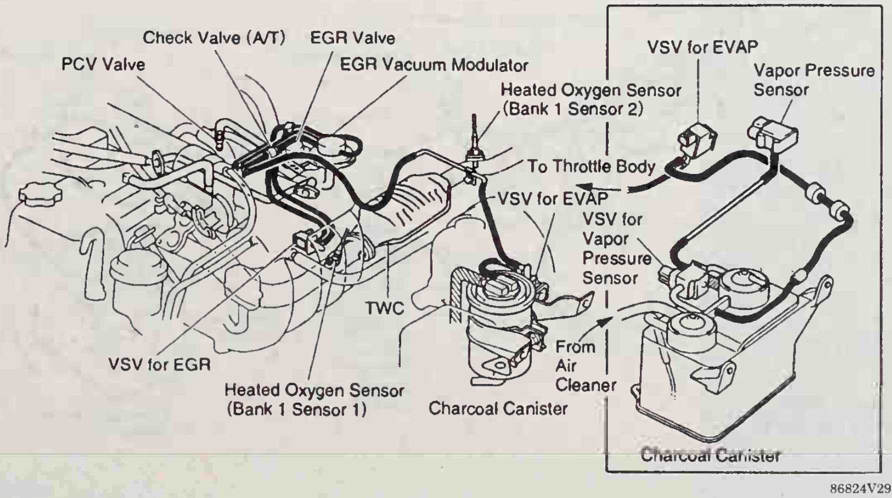

Check Valve (A/T)
EGR Valve
PCV Valve
EGR Vacuum Modulator
VSV for EVAP
Vapor Pressure Sensor
Heated Oxygen Sensor (Bank 1 Sensor 2)
To Throttle Body
VSV for EVAP
VSV for Vapor Pressure Sensor
TWC
From Air Cleaner
VSV for EGR
Heated Oxygen Sensor (Bank 1 Sensor 1)
Charcoal Canister
Charcoal Canister
86824V29

Fig. 121 Vacuum hose routing — 1996 2RZ-FE

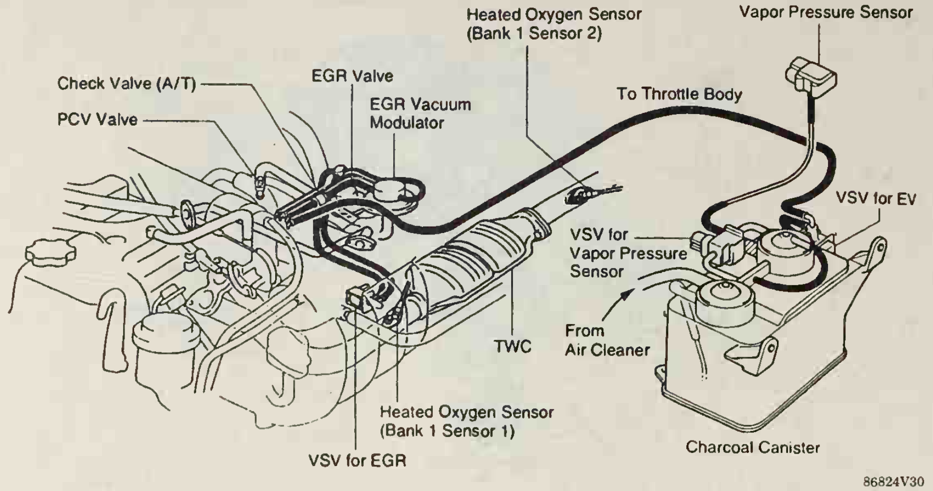

Heated Oxygen Sensor (Bank 1 Sensor 2)
Vapor Pressure Sensor
Check Valve (A/T)
EGR Valve
EGR Vacuum Modulator
To Throttle Body
PCV Valve
VSV for EV
VSV for Vapor Pressure Sensor
From Air Cleaner
TWC
Heated Oxygen Sensor (Bank 1 Sensor 1)
VSV for EGR
Charcoal Canister
86824V30

Fig. 122 Vacuum hose routing — 1996 3RZ-FE

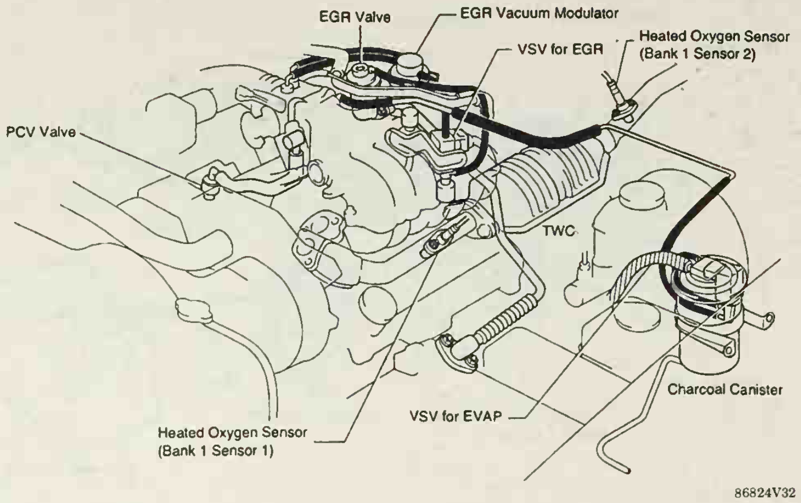

EGR Valve
EGR Vacuum Modulator
VSV for EGR
Heated Oxygen Sensor (Bank 1 Sensor 2)
PCV Valve
TWC
Charcoal Canister
VSV for EVAP
Heated Oxygen Sensor (Bank 1 Sensor 1)
86824V32

Fig. 123 Vacuum hose routing — 1995 5VZ-FE

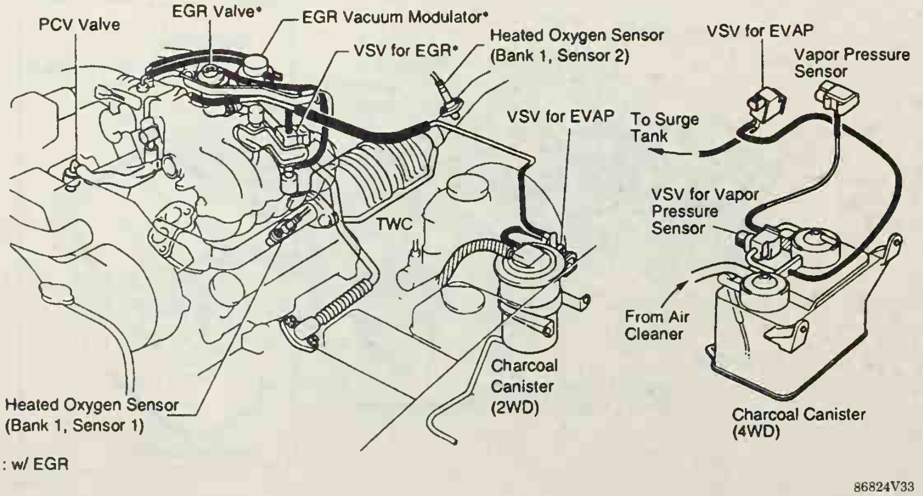

PCV Valve
EGR Valve*
EGR Vacuum Modulator*
VSV for EGR*
Heated Oxygen Sensor (Bank 1, Sensor 2)
VSV for EVAP
Vapor Pressure Sensor
VSV for EVAP
To Surge Tank
TWC
VSV for Vapor Pressure Sensor
From Air Cleaner
Charcoal Canister (2WD)
Charcoal Canister (4WD)
Heated Oxygen Sensor (Bank 1, Sensor 1)
* : w/ EGR
86824V33

Fig. 124 Vacuum hose routing — 1996 5VZ-FE

5

FUEL SYSTEM

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BASIC FUEL SYSTEM DIAGNOSIS

When there is a problem starting or driving a vehicle, two of the most important checks involve the ignition and the fuel systems. The questions most mechanics attempt to answer first, "is there spark?" and "is there fuel?" will often lead to solving most basic problems. For ignition system diagnosis and testing, please refer to the information on engine electrical components and ignition systems found earlier in this manual. If the ignition system checks out (there is spark), then you must determine if the fuel system is operating properly (is there fuel?).

CARBURETED FUEL SYSTEM

Understanding the Fuel System

An automotive fuel system consists of everything between the fuel tank and the carburetor. This includes the tank itself, the fuel lines, one fuel filter, a mechanical fuel pump, and the carburetor.

With the exception of the carburetor, the fuel system is quite simple in operation. Fuel is drawn from the tank through the fuel line by the fuel pump, which forces it through the fuel filter to the carburetor, where it is distributed to the cylinders.

Precautions

- Before working on the fuel system, disconnect the negative battery cable.
- Keep gasoline off rubber or leather parts.
- When working around fuel, keep away from possible fire hazards; DO NOT SMOKE.
- Keep your work area clean to avoid contamination of the carburetor and its components.
- Work on only one component group at a time to avoid any confusion between similar looking parts.
- Be careful not to mix-up or loose any clips or springs.

Mechanical Fuel Pump

All 22R carbureted engines are equipped with a mechanically operated fuel pump of diaphragm construction (some models use two different types of pump). A separate fuel filter is incorporated into the fuel line (see Section 1 for its required service). The fuel pump is located on the right side of the cylinder head.

REMOVAL & INSTALLATION

See Figure 1

1. Disconnect the negative battery cable.
2. Drain the radiator coolant.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Disconnect the upper radiator hose and wire it out of the way.
4. Label, disconnect and plug the three fuel lines from the fuel pump.
5. Unscrew the two fuel pump retaining bolts. Remove the fuel pump, gaskets and insulator.
6. Inspect the insulator for any cracks or damage. Replace if necessary.

To install:

7. Place new gaskets on either side of the insulator. Insert the pump arm through the hole of the insulator/gaskets and mount on the engine. Tighten the two mounting screws.

➡Always use new gaskets when installing the fuel pump.

8. Reconnect the fuel lines.
9. Attach the upper radiator hose, then fill the system with a coolant/water mixture.
10. Connect the negative battery cable.
11. Start the engine and check for any leaks. Top off the cooling system.

TESTING

Fuel pumps should always be tested on the vehicle. The larger line between the pump and tank is the suction side of the system and the smaller line, between the pump and carburetor is the pressure side. A leak in the pressure side would be apparent because of dripping fuel. A leak in the suction side is usually only apparent because of a reduced volume of fuel delivered to the pressure side.

⁂CAUTION

Gasoline, both liquid and vapor, is extremely explosive. Extinguish all open flames in the area including smoking materials, heaters, welders, etc. Contain all spillage and keep away from sources of high temperature. Have a dry powder (Type B-C) fire extinguisher within arm's reach and know how to use it.

1. Tighten any loose line connections and look for any kinks or restrictions.
2. Disconnect the fuel line at the carburetor or fuel pump. Disconnect the distributor-to-coil primary wire. Place a container at the end of the fuel line and crank the engine a

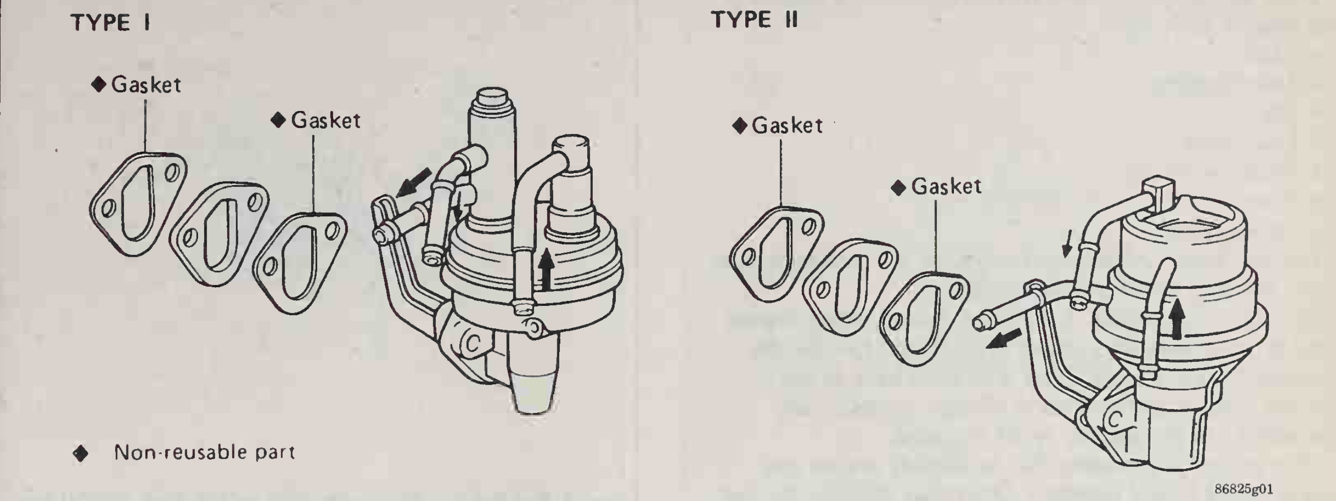


Fig. 1 Mechanical fuel pump types with their insulators and gaskets

few revolutions. If little or no fuel flows from the line, either the fuel pump is inoperative or the line is plugged. Blow through the lines with compressed air and try the test again. Reconnect the line.

3. If fuel flows in good volume, check the fuel pump pressure to be sure.
4. Attach a pressure gauge to the pressure side of the fuel line. On trucks equipped with a vapor return system, squeeze off the return hose.
5. Run the engine at idle and note the reading on the gauge. Stop the engine and compare the reading with the specifications listed in the "Tune-Up Specifications" chart. If the pump is operating properly, the pressure will be as specified and will be constant at idle speed. If pressure varies sporadically or is too high or low, the pump should be replaced.
6. Remove the pressure gauge.

Carburetor

➧ **See Figure 2**

The carburetor is the most complex part of the fuel system. Carburetors vary greatly in construction, but they all operate basically the same way; their job is to supply the correct mixture of fuel and air to the engine in response to varying conditions.

Despite their complexity in operation, carburetors function because of a simple physical principle; the venturi principle. Air is drawn into the engine by the pumping action of the pistons. As the air enters the top of the carburetor, it passes through a venturi, which is nothing more than a restriction in the throttle bore. The air speeds up as it passes through the venturi, causing a slight drop in pressure. This pressure drop pulls fuel from the float bowl through a nozzle into the throttle bore, where it mixes with the air and forms a fine mist, which is distributed to the cylinders through the intake manifold.

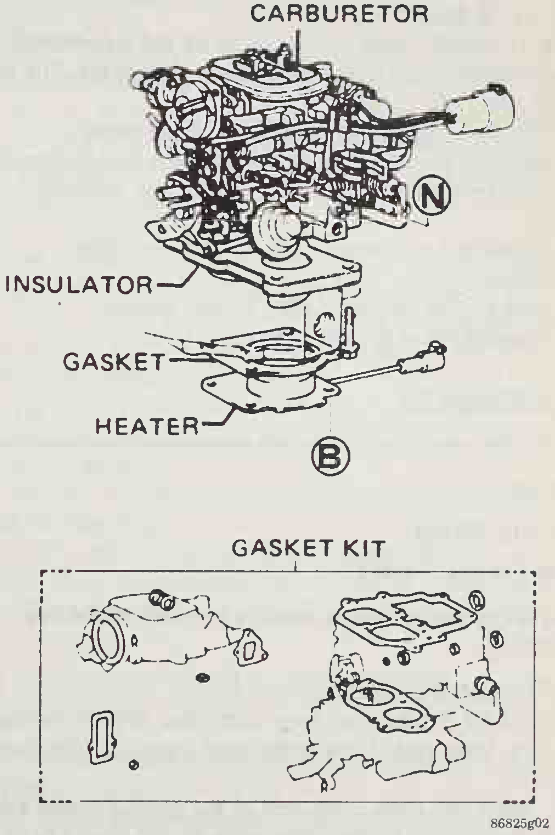


Fig. 2 The carburetor sits atop an insulator, gasket and heater unit

There are multiple systems (air/fuel circuits) in a carburetor that make it work; the

- Float
- Main Metering
- Idle
- Low-Speed
- Accelerator Pump
- Power
- Choke system

The way these systems are arranged in the carburetor determines the carburetor's size and shape.

Carburetors all function in the same fashion; larger engines have larger carburetors to move more air and fuel, but the principle is still the same. Older units don't have as many external linkages and controls to manage emissions and driveability, but the principle is still the same.

It's important to remember that carburetors seldom give trouble during normal operation. Other than changing the fuel and air filters and making sure the idle speed is OK at every tune-up, there's not much maintenance you can perform on the average carburetor. Quality of fuel and presence of water in the system will affect the carburetor; dirt particles in the fuel can clog the jets and water causes rust and corrosion. If the vehicle is to be parked or stored for a long period of time, drain the carburetor to prevent the evaporating fuel from gumming up the system.

The carburetors used on Toyota trucks are conventional 2 bbl, downdraft types similar to domestic carburetors. The main circuits are:

- Primary — for normal operational requirements
- Secondary — to supply high speed/high load fuel needs
- Float — to supply fuel to the primary and secondary circuits
- Accelerator — to supply fuel for quick and safe acceleration
- Choke — for reliable starting in cold weather
- Power valve — for fuel economy

ADJUSTMENTS

Fast Idle

OFF THE TRUCK

➧ See Figures 3 and 4

➡An angle gauge tool is used to properly make this adjustment.

1. Remove the carburetor.
2. Set the throttle shaft lever to the first step of the fast idle cam. Make certain the choke plate (blade) is completely closed.
3. Attach the blade angle tool to the primary throttle blade. Adjust the primary throttle blade angle to 23° (Calif.) or 24.5° (Federal and Canada) from horizontal by turning the fast idle screw.
4. Remove the angle tool from the carburetor and install the carburetor as previously outlined.

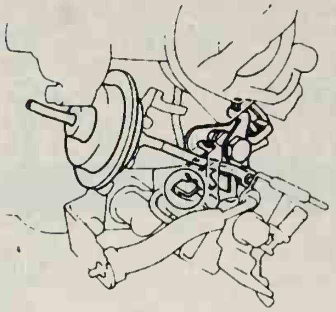


Fig. 3 Set the throttle shaft lever to the first step of the fast idle cam

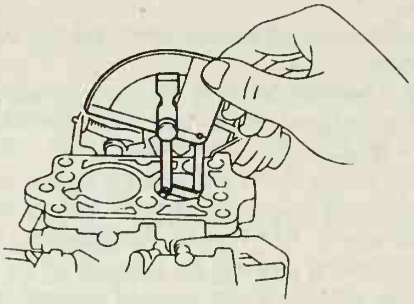


Fig. 4 With the proper angle tool, adjust by turning the fast idle screw

ON THE TRUCK

➧ See Figures 5, 6, 7 and 8

1. Start the engine and allow it to reach normal operating temperature.
2. Stop the engine and connect a tachometer to the engine.
3. Remove the air cleaner assembly.
4. Disconnect and plug the vacuum hoses for the Hot Air Intake (HAI) and Mixture Control (MC) systems if so equipped. Disconnect and plug the vacuum hose from the choke opener diaphragm and Exhaust Gas Recirculation (EGR) valve; plug the ends.
5. Make certain that all accessories are switched OFF.
6. Open the throttle valve slightly, push the choke plate fully closed and release the throttle. This sets the carburetor in the fast idle position.
7. Without touching the accelerator pedal, start the engine and read the tachometer. If necessary, adjust the fast idle

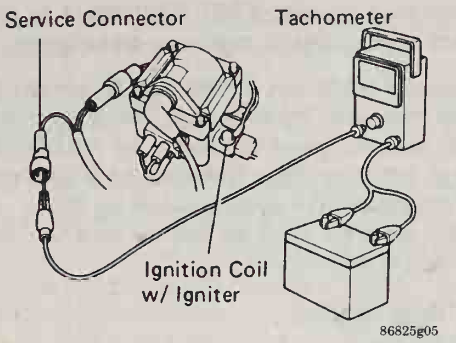


Fig. 5 Attach the tachometer test probe to the ignition coil negative terminal

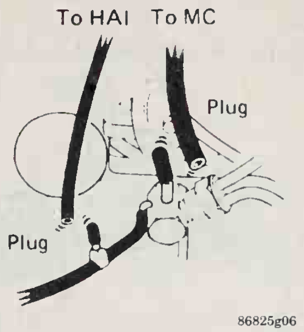


Fig. 6 Plug the vacuum hose ends that were disconnected

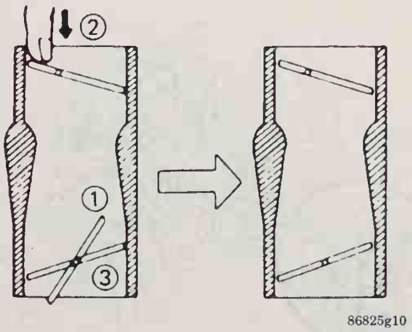


Fig. 7 While holding the throttle valve slightly open, push the choke valve closed. Hold it closed as you release the throttle valve

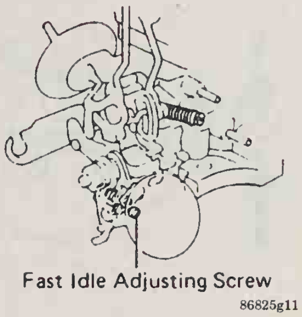


Fig. 8 Adjust the fast idle screw to the correct rpm

speed to by turning the fast idle screw. Correct fast idle speed: Federal, 3000 rpm; California, 2600 rpm.

8. Stop the engine. Reconnect the vacuum hoses, disconnect the tachometer and reinstall the air cleaner.

Float and Fuel Level

➧ See Figures 9, 10 and 11

Float level adjustments are unnecessary if the fuel level falls within the lines on the sight glass when the engine is running. The sight glass is located on the side of the carburetor and is literally a window to the float bowl. Removing the air cleaner is usually required for access, although it can be done with an extension or dental mirror.

With the carburetor off the engine, there are two float level adjustments which may be made. One is done with the air horn inverted, so that the float is in a fully raised position; the other is with the air horn in an upright position, so that the float falls to the bottom of its travel.

The float level is measured either with a special carburetor float level gauge, which comes with a rebuilding kit, or with a standard wire gauge.

1. Turn the air horn upside down and let the float hang down by its own weight.
2. Using a special float gauge SST 09240-00014 or equivalent, check the clearance between the tip of the float and the flat surface of the air horn. The clearance should be 0.386 in. (9.8mm).

➡This measurement should be made without the gasket on the air horn.

3. If the float clearance is not within specifications, adjust it by bending the upper (A) float tab.
4. Lift up the float and check the clearance between the air horn and the float bottom. A Vernier caliper works well for this measurement. The clearance should be 48mm (1.89 inches)
5. If the clearance is not within specifications, adjust it by bending the lower float tab (B).

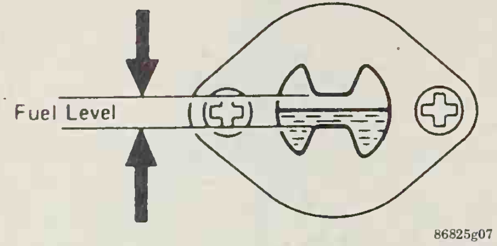


Fig. 9 The sight glass is located on the side of the carburetor

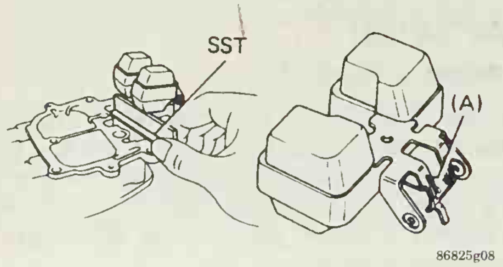


Fig. 10 Bend portion (A) of the float to achieve a 0.386 in. (9.8mm) gap

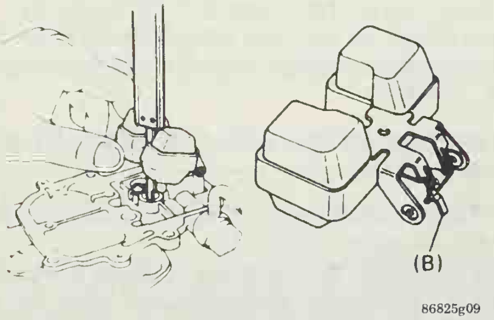


Fig. 11 Bend portion (B) of the float to set 1.89 in. (48mm) of clearance between the air horn and the float bottom

Choke Unloader

▶ See Figure 12

➡You will need the use of SST 09240-00014 or its equivalent angle gauge to make any adjustments.

The unloader adjustment is made with the primary throttle valve fully open. With the valve open, check the choke valve angle with a special gauge supplied in the rebuilding kit or with a gauge of the proper angle fabricated out of cardboard. The angle of the choke valve opening should be 45°.

To adjust the angle, bend the fast idle lever until the proper measurement is achieved.

Throttle Valve Opening

▶ See Figure 13

➡You will need the use of SST 09240-00014 or its equivalent angle gauge to make any adjustments.

1. Check the full opening of the primary and secondary throttle valves.

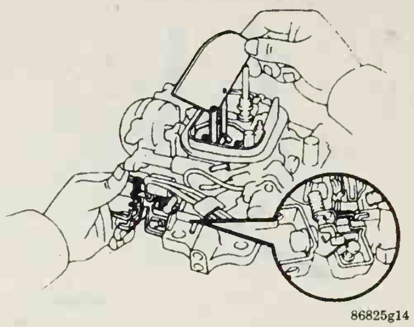


Fig. 12 Bend the primary throttle arm 45° from the horizontal plane

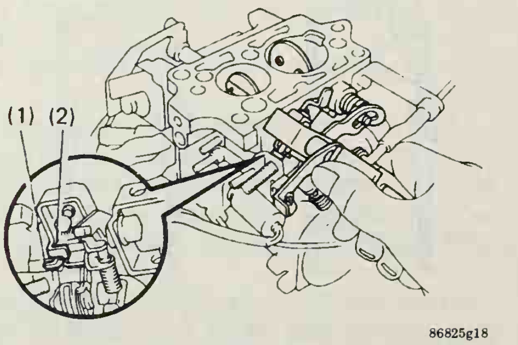


Fig. 13 Adjust by bending the respective first throttle arm levers for the primary (1) and secondary (2)

2. Adjust by bending the respective first throttle arm levers for the primary (1) and secondary (2). The standard angle should read:

Primary — 90° from the horizontal plane
Secondary — 90° from the horizontal plane

Secondary Touch Angle

➧ See Figure 14

➡You will need the use of SST 09240-00014 or its equivalent angle gauge to make any adjustments.

1. Check the primary throttle valve opening at the same time the second throttle valve just starts to open.
2. Standard angle is 59° from the horizontal plane.
3. It is not necessary to adjust the secondary touch angle.

Choke Opener

➧ See Figures 15 and 16

1. Apply vacuum to the choke opener diaphragm.
2. Check that the fast idle cam is releasing to the fourth step. Adjust it by bending the choke opener lever A.
3. Disconnect the vacuum hose.
4. Close the choke valve, then set the fast idle lever to the first step.
5. Check that there is clearance between the choke opener lever and the fast idle cam.

Choke Breaker

1. With the engine **OFF** and the air cleaner removed, apply vacuum to the choke breaker diaphragm.
2. Close the choke by hand, and remove your hand. With an angle gauge, check that the angle of the choke plate is 42° from horizontal.
3. If the angle is incorrect, adjust it by bending the choke breaker link.

Idle-Up Diaphragm

1. Apply vacuum to the idle-up diaphragm.

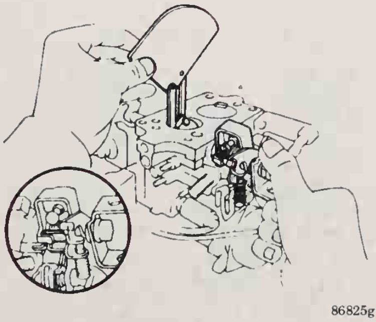


Fig. 14 Using the angle adjusting tool, check the throttle valve opening at the same time the second throttle valve opens

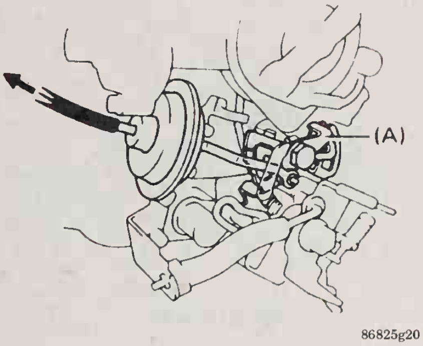


Fig. 15 With vacuum attached to the diaphragm, check that the fast idle cam is released to the fourth step. Adjust by bending the choke opener lever A

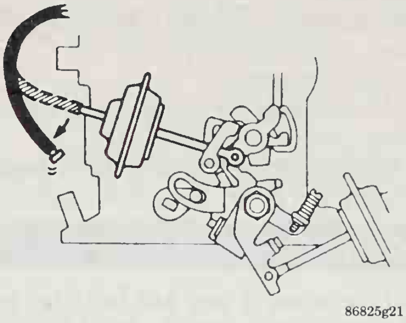


Fig. 16 Disconnect and plug the vacuum hose

2. Check the throttle valve opening angle. Adjust by turning the adjusting screw. With an angle gauge, check that the standard angle is 16.5° from the horizontal plane.

Air Valve and Metering Needle

➧ See Figure 17

1. Check that the air valve and metering needle move smoothly together.
2. While the primary throttle valve angle is in idle position, check the air valve opening angle.
3. While the primary throttle valve is at a full opening angle, check that there is clearance between the connecting rod and the stopper.

Idle Mixture Screw

➧ See Figures 18, 19, 20, 21, 22, 23, 24, 25 and 26

As stated in section 2, the mixture adjusting screw (MAS) should be the very last item you try to adjust during tune-up or troubleshooting. The MAS is concealed behind a plug; the plug

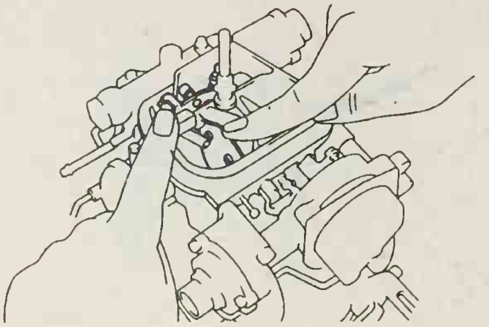


Fig. 17 Make sure the air valve and metering needle move smoothly together

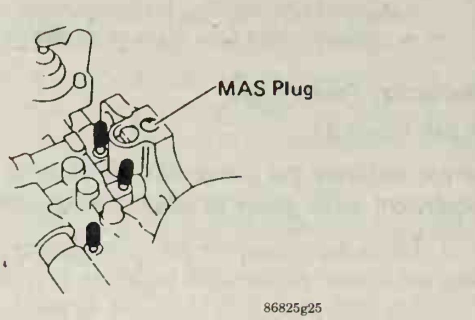


Fig. 19 After plugging all of the carburetor lines, punch a hole in the center of the MAS plug

cannot be removed with the carburetor on the truck. If adjustment is to be done, great care must be taken during removal of the plug; clearances are very tight and damage to the carburetor can occur.

1. Tag and disconnect all hoses and linkages attached to the carburetor.
2. Remove the carburetor.
3. Plug each carburetor vacuum port to prevent entry of metal particles.
4. Mark the center of the MAS plug with a punch. Drill a 0.256 in. (6.5mm) hole in the center of the plug.

✲✲WARNING

The head of the screw is only 0.04 in. (1mm) below the plug — drill carefully and slowly to avoid damage.

5. The plug may come out with the drill at this time. If not, use a small screwdriver to reach through the hole and gently turn the adjusting screw all the way in. Do NOT overtighten the screw; just tighten it until it touches bottom.

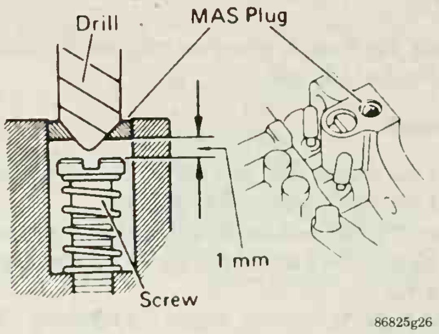


Fig. 20 Be careful, notice how close the screw is when you drill 0.256 in. (6.5mm) into the plug

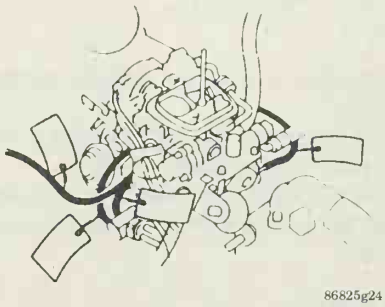


Fig. 18 Tag and disconnect any hoses or linkages to the carburetor

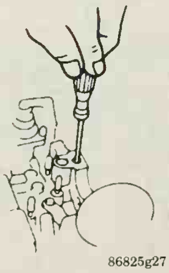


Fig. 21 Use a small screwdriver to reach into the hole

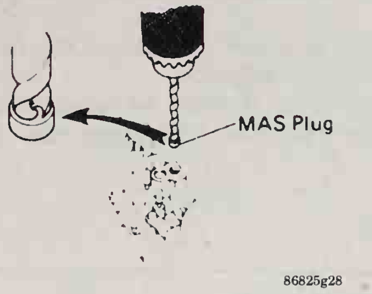

MAS Plug
86825g28

Fig. 22 To remove the MAS plug, use a 0.295 in. (7.5mm) drill bit

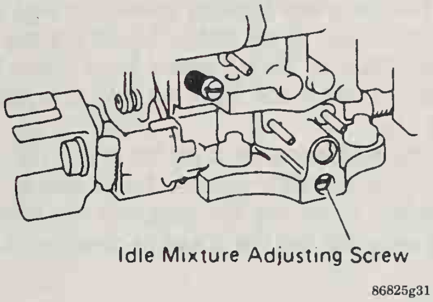

Idle Mixture Adjusting Screw
86825g31

Fig. 25 Location of the idle mixture adjusting screw

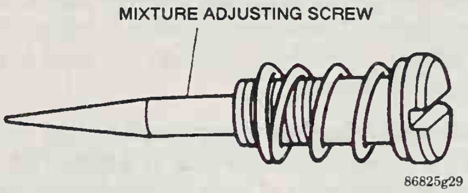

MIXTURE ADJUSTING SCREW
86825g29

Fig. 23 Inspect the screw for any damage during removal; if any is found, replace the screw

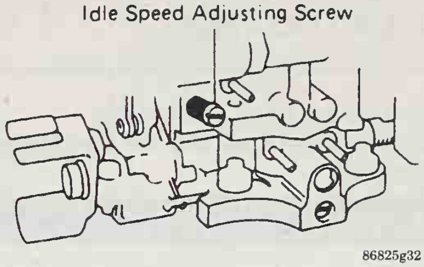

Idle Speed Adjusting Screw
86825g32

Fig. 26 The idle speed adjusting screw protrudes from the carburetor

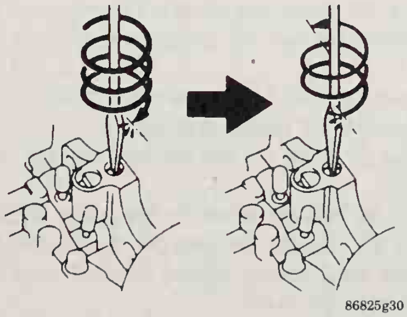


Fig. 24 Fully tighten the adjusting screw, then loosen it 3½ turns

6. Use a 0.295 in. (7.5mm) drill to force the plug off.
7. Remove the adjusting screw. Inspect the tip for any damage; remove any steel particles. If the drill has damaged the top of the screw, it must be replaced.
8. Reinstall the adjusting screw. Turn it all the way in, just touching bottom.
9. Once the screw has bottomed, turn it out 3½ turns.
10. Reinstall the carburetor and air cleaner.
11. Before adjusting idle speed and mixture, ALL the following conditions must be met:
    a. Air cleaner properly installed.
    b. Engine running at normal operating temperature.
    c. Choke fully opened.
    d. All accessories OFF.
    e. All vacuum lines connected.
    f. Ignition timing correctly set.
    g. Transmission in neutral.
    h. Fuel level should be approximately centered in float glass.
    i. For Calif. vehicles, EBCV off.

12. Connect a tachometer.
13. Start the engine.
14. Turn the MAS until the highest possible rpm is achieved.
15. Turn the idle speed adjusting screw until 740 rpm is achieved. The idle speed adjusting screw is located above and to the left (10 o'clock) of the mixture adjusting screw.
16. Repeat Steps 13 and 14 several times. When the idle does not rise no matter how much the MAS is turned, proceed to the next Step.
17. Turn the MAS screw IN to set the idle to 700 rpm.
18. Turn the engine **OFF.** Remove the air cleaner.
19. Gently tap a new plug into place over the MAS plug. Check and adjust the fast idle speed as described in this section.

➡The method used to set the idle mixture and speed is also known as the Lean Drop Method.

Automatic Choke Inspection

The automatic choke system sets and opens completely automatically, with no input from the accelerator pedal. The driver no longer sets the choke; it is set by the expansion or contraction of the bimetal coil. Refer to section 4, Emission Controls, for complete inspection procedures.

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Loosen the radiator drain plug and drain the coolant into a suitable container.

⁂CAUTION

When draining coolant, keep in mind that cats and dogs are attracted by ethylene glycol antifreeze, and are quite likely to drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant may be reused unless it is contaminated or several years old.

3. Unscrew the mounting screws and remove the air filter housing. Disconnect all hoses and lines leading from the air cleaner.
4. Tag and disconnect all fuel, vacuum, coolant and electrical lines or hoses leading from the carburetor.
5. Disconnect the accelerator linkage from the carburetor. On trucks equipped with an automatic transmission, disconnect the throttle cable linkage running from the transmission.
6. Remove the four carburetor mounting bolts and lift off the carburetor and its gasket.

➡Cover the manifold opening with a clean rag to prevent objects from falling into the engine.

To install:

7. Install the carburetor, tighten the mounting bolts and reconnect all linkages.
8. Connect the vacuum and fuel lines; connect the wiring harness.
9. Install the air cleaner assembly, making sure it is correctly seated on the carburetor.
10. Refill the coolant. Connect the negative battery cable.
11. Start the engine and check for any leaks. Check the float level.

OVERHAUL

➧ See Figures 27 and 28

Efficient carburetion depends on careful cleaning and inspection during overhaul, since dirt, gum, water, or varnish in or on the carburetor parts are often responsible for poor performance.

Overhaul your carburetor in a clean, dust-free area. Carefully disassemble the carburetor, referring often to the exploded views. Keep all similar and look-alike parts segregated during disassembly and cleaning to avoid accidental interchange during assembly.

Carburetor overhaul kits are recommended for each overhaul. These kits contain all gaskets and new parts to replace those that deteriorate most rapidly. Failure to replace all parts supplied with the kit (especially gaskets) can result in poor performance and a leaks.

➡The following procedure is organized so that only one group of components is worked on at a time. This will help eliminate confusion of parts or sub-assemblies on the bench. Always keep parts in order; take great care not to lose small parts or clips.

Disassembly

AIR HORN

➧ See Figures 29, 30, 31, 32 and 33

1. Remove the carburetor.
2. To release the terminal from the connector, pry up on the locking lugs with a flat-bladed tool, then pull out the terminals.
3. Loosen the screw and remove the metering needle.
4. Disconnect the fast idle linkage and air valve connecting rod.
5. Remove the 5 air horn screws and lift the air horn from the body. Remove the gasket and discard it.
6. Remove the pivot pin and the float with the needle valve.
7. Loosen the retainer screw for the power piston. Hold the piston, rotate the retainer, then remove the piston and spring.
8. Remove the 3 screws holding the outer vent control valve and remove the valve.

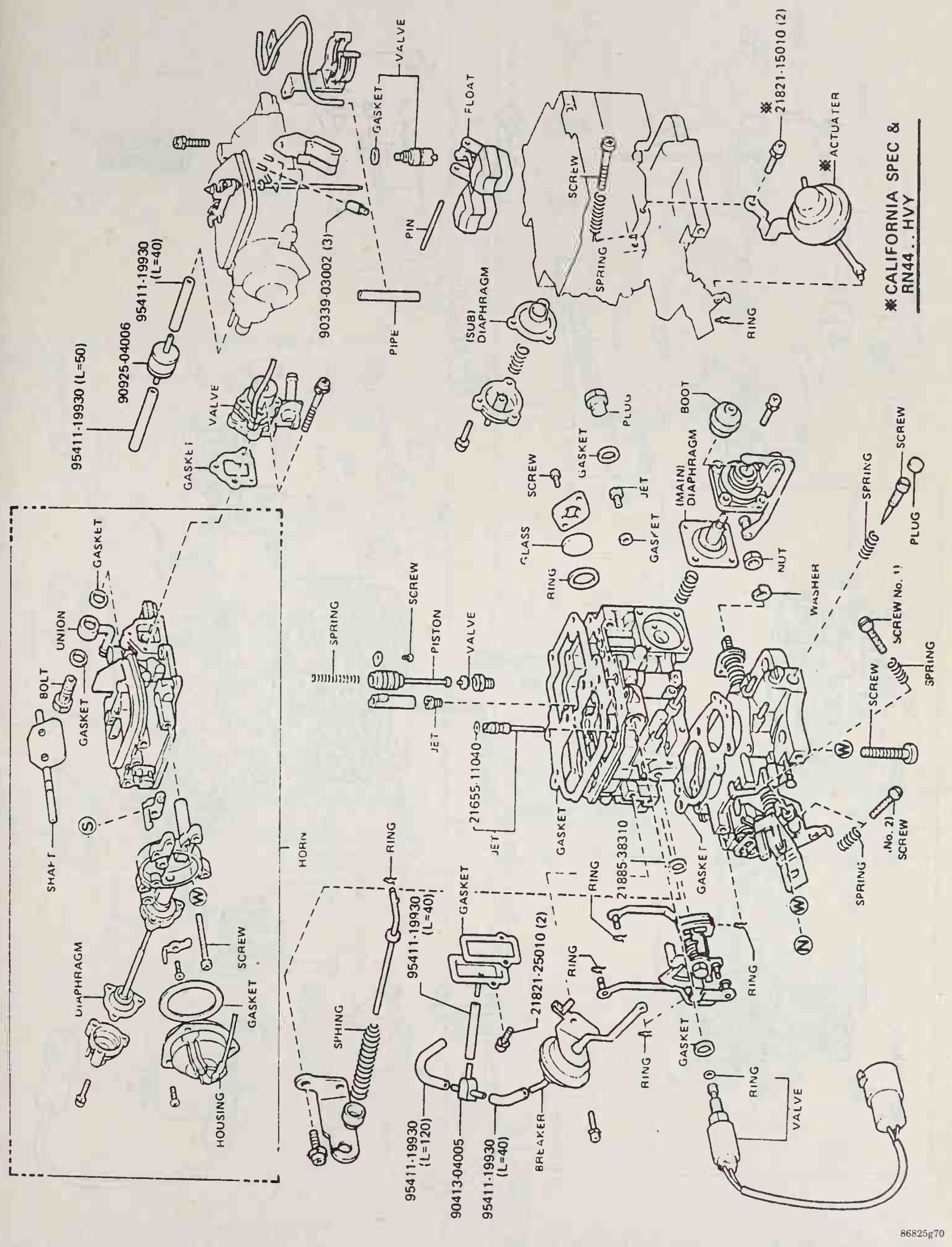

95411-19930 (L=50)
90925-04006
95411-19930 (L=40)
90339-03002 (3)
GASKET
VALVE
PIN
FLOAT
PIPE
(SUB) DIAPHRAGM
SCREW
SPRING
RING
※ 21821-15010 (2)
※ ACTUATER
※ CALIFORNIA SPEC & RN44 .. HVY
GASKET
VALVE
SHAFT
BOLT
GASKET
UNION
GASKET
S
W
DIAPHRAGM
SCREW
GASKET
HOUSING
HORN
SPRING
SCREW
PISTON
VALVE
JET
21655-11040
JET
RING
95411-19930 (L=40)
GASKET
21821-25010 (2)
SPRING
95411-19930 (L=120)
90413-04005
95411-19930 (L=40)
BREAKER
RING
GASKET
21885-38310
RING
GASKET
RING
RING
GLASS
SCREW
GASKET
PLUG
JET
GASKET
(MAIN) DIAPHRAGM
BOOT
NUT
WASHER
SCREW No. 1
SPRING
SCREW
PLUG
SCREW
W
SPRING
No. 2 SCREW
N
W
RING
RING
VALVE
GASKET
86825g70

Fig. 27 Exploded view of the carburetor — USA (including California)

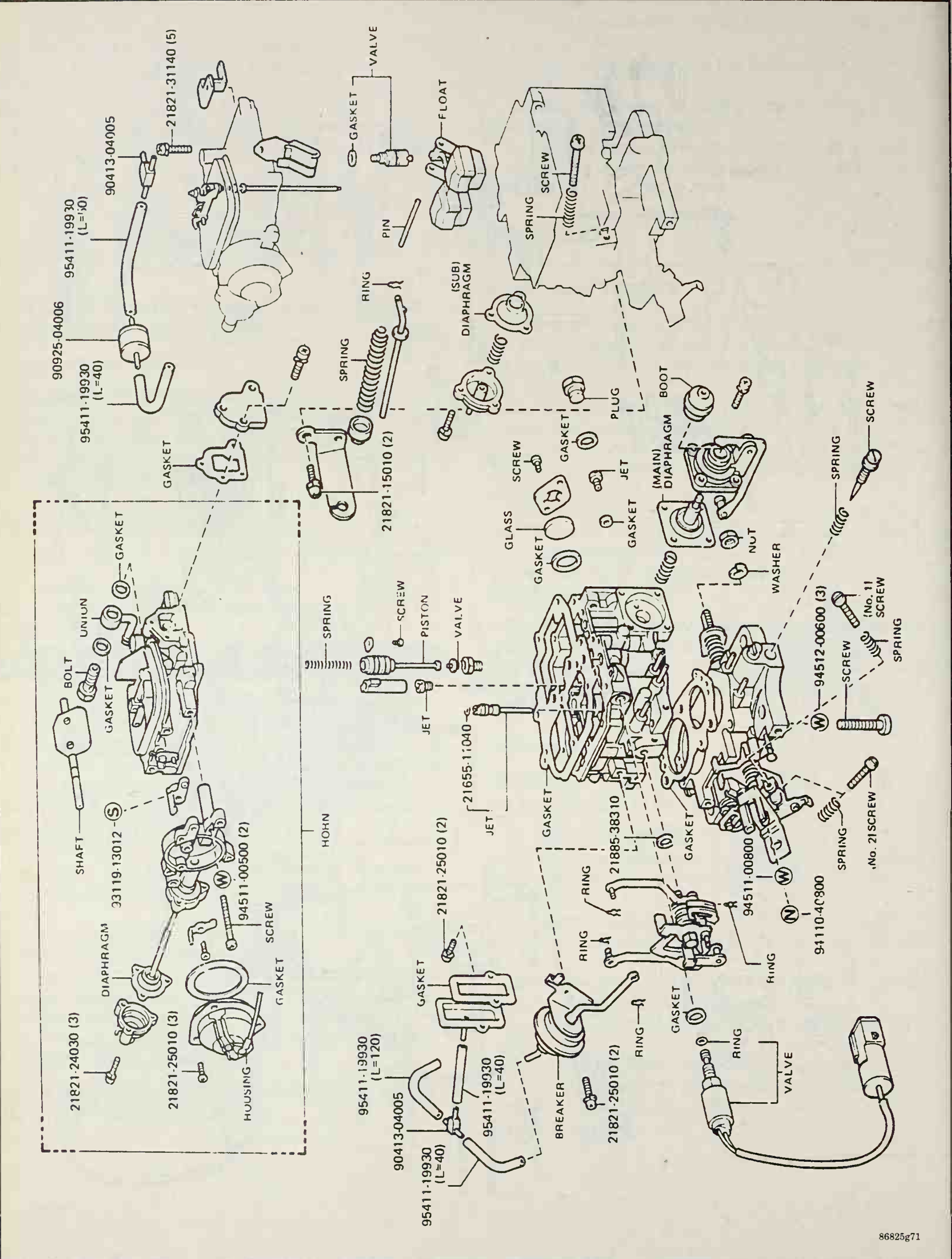

21821-31140 (5)
90413-04005
95411-19930 (L=50)
90925-04006
95411-19930 (L=40)
GASKET
VALVE
FLOAT
PIN
RING
SPRING
(SUB) DIAPHRAGM
SCREW
SPRING
PLUG
BOOT
GASKET
SCREW
JET
(MAIN) DIAPHRAGM
GLASS
GASKET
GASKET
GASKET
NUT
WASHER
SPRING
SCREW
94512-00600 (3)
(No. 1) SCREW
SPRING
SCREW
W
No. 2 SCREW
SPRING
21821-15010 (2)
GASKET
BOLT
UNION
GASKET
GASKET
SHAFT
33119-13012
S
W
94511-00500 (2)
SCREW
DIAPHRAGM
21821-24030 (3)
21821-25010 (3)
HOUSING
GASKET
HORN
SPRING
SCREW
PISTON
VALVE
JET
21655-11040
JET
GASKET
21885-38310
GASKET
94511-00800
W
N
94110-40800
RING
RING
RING
21821-25010 (2)
GASKET
95411-19930 (L=120)
90413-04005
95411-19930 (L=40)
95411-19930 (L=40)
BREAKER
21821-25010 (2)
RING
GASKET
RING
VALVE
86825g71

Fig. 28 Exploded view of the carburetor — Canada

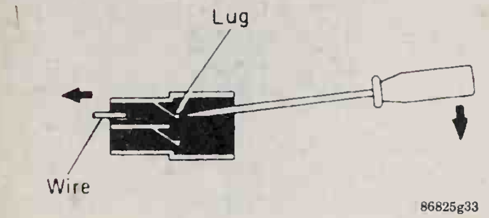

Lug
Wire
86825g33

Fig. 29 Pry up on the locking lugs and pull out the terminals

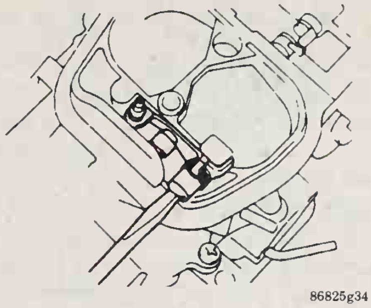


Fig. 30 Loosen the screw, then remove the metering needle

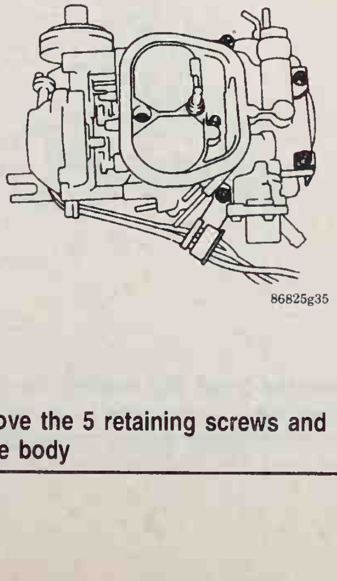


Fig. 31 Remove the 5 retaining screws and lift the air horn from the body

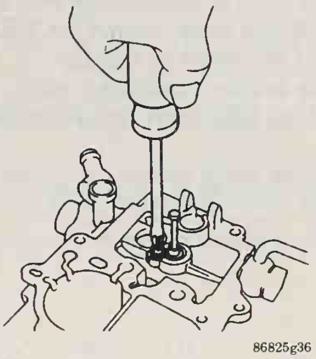


Fig. 32 Loosen the retainer screw for the power piston. Hold the piston and rotate the retainer, then remove the piston and spring

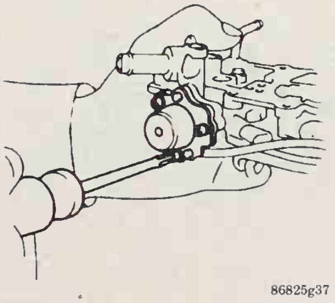


Fig. 33 Remove the three mounting screws for the outer vent control valve

CARBURETOR BODY

See Figures 34, 35, 36, 37, 38, 39 and 40

1. Using a set of carburetor wrenches or special tool 09922-00010, remove the following:
   - slow jet (1)
   - power valve (2)
   - metering needle guide (3)
   - secondary main jet (4)
   - plug (5)
   - primary main jet (6)

   Use the illustration to help you.
2. Remove the fuel cut solenoid from the carburetor body.
3. At the accelerator pump, remove the 4 screws. Remove the pump housing, diaphragm and spring.
4. Remove the auxiliary acceleration pump.
5. Disconnect the linkage and remove the idle-up diaphragm.
6. Disconnect the choke opener link; remove the choke opener.

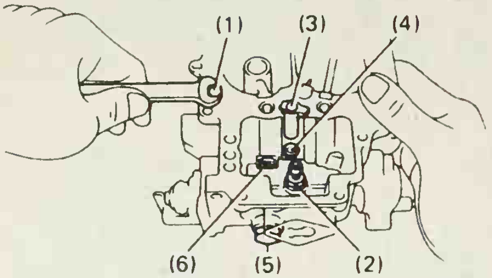


Fig. 34 Note the positions of the various items: (1) slow jet, (2) power valve, (3) metering needle guide, (4) secondary main jet, (5) plug, and (6) primary main jet

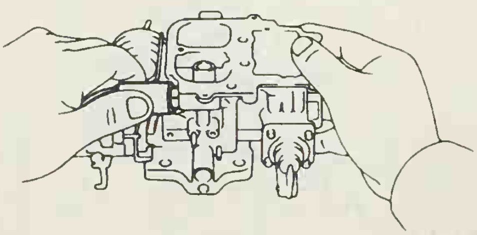


Fig. 35 The fuel cut solenoid is located on the side of the carburetor

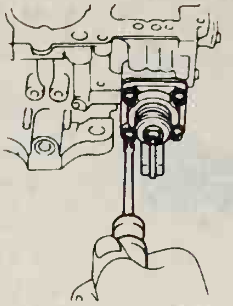


Fig. 36 Four screws mount the accelerator pump on the side of the carburetor

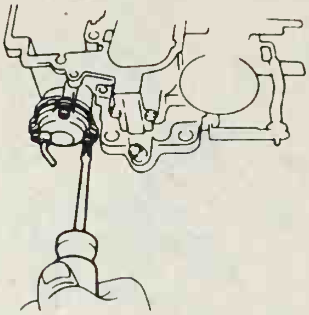


Fig. 37 Three screws mount the auxiliary accelerator pump on the side of the carburetor

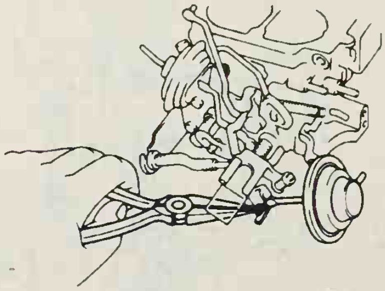


Fig. 38 Remove the small clip holding the diaphragm linkage

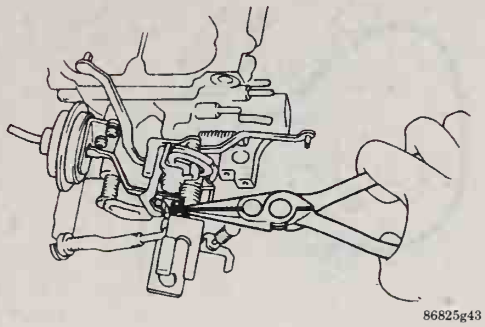


Fig. 39 A small clip also holds the choke opener linkage

7. Remove the three screws and separate the body from the flange (lowest portion).

Cleaning and Testing

➧ See Figures 41, 42, 43, 44, 45, 46 and 47

1. Clean all the cast metal parts with a soft brush and carburetor solvent. Clean any carbon from around the throttle plates. Blow out all jets and passages with compressed air.
2. Inspect the following:
   - pivot pin for scratches and excessive wear (1)
   - float for a broken lip or wear in the pivot pin holes (2)
   - spring for any breaks or deformation (3)
   - plunger (5) and needle valve (4) for wear or damages
   - strainer for breaks or rust (6)
3. Inspect the power piston. Make sure it moves smoothly.
4. Check for any faulty opening and closing action of the power valve.
5. Test the fuel cut solenoid. Connect the wire leads to the battery terminals; you should feel a distinct click inside the solenoid as power is connected and disconnected at the bat-

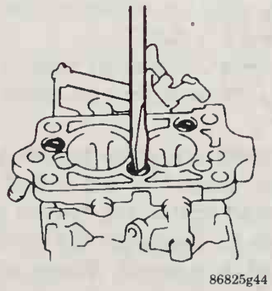


Fig. 40 Remove the three screws, then separate the body from the flange (lowest portion)

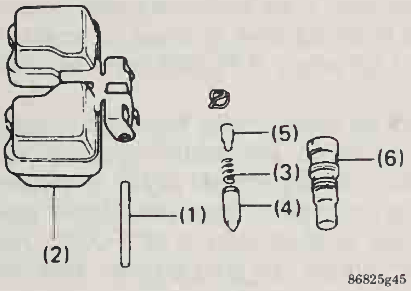


Fig. 41 Exploded view of the float and needle valve

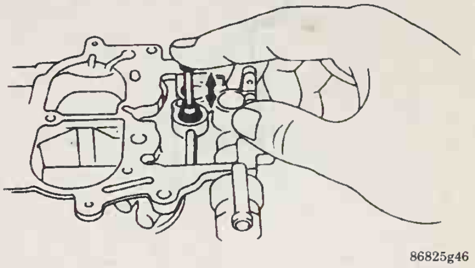


Fig. 42 Using your finger, gently push the power piston to check for binding

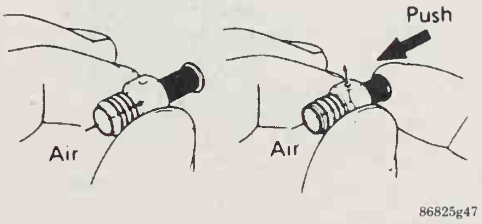


Fig. 43 Push the end of the power valve as shown to check for any hesitation in movement

tery. If this click is not felt, replace the solenoid. Replace the O-ring.

6. Inspect the outer vent control valve for damaged valve or valve seat. Check the valve for smoothness of motion. Connect the wire leads to the battery terminals; you should feel a distinct click inside the valve as power is connected and disconnected at the battery. If this click is not felt, replace the solenoid.

7. Inspect the choke breaker diaphragm by applying vacuum to the diaphragm. The vacuum should not drop immediately and the choke should open slightly as vacuum is applied.

8. Use an ohmmeter to check choke heater resistance. Resistance should be 20-22 ohms at 68°F (20°C). Resistance will vary with temperature; use good judgment when interpreting test results.

9. Inspect the choke opener and idle-up diaphragms. Apply vacuum to the diaphragm; vacuum should not drop immediately and the linkages should move when vacuum is applied.

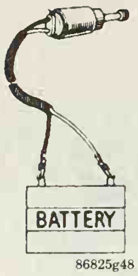


Fig. 44 Attach the wire leads to a battery; a click should be heard from the solenoid valve when the power is connected and disconnected

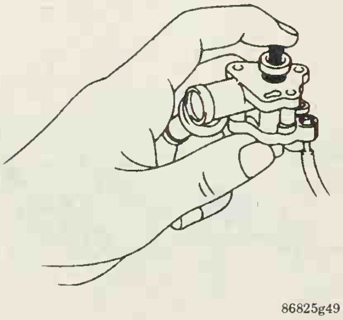


Fig. 45 Pushing the rod of the outer vent control valve, check for smoothness in the movement

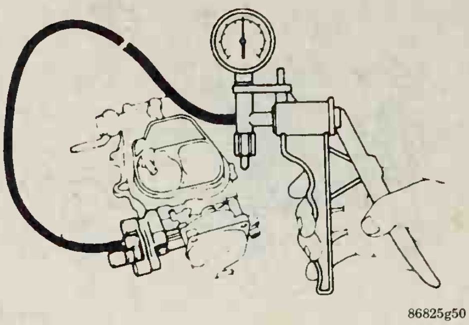


Fig. 46 Attach a vacuum gauge to the choke breaker diaphragm

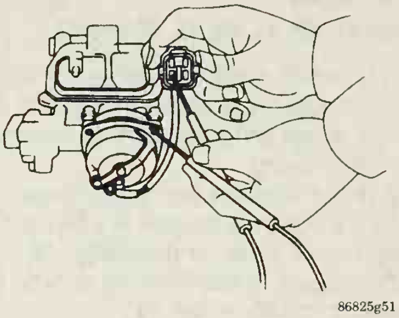


Fig. 47 Testing the choke heater resistance with an ohmmeter between the terminal and the heater housing

Assembly

BODY

➧ **See Figures 48, 49, 50, 51, 52, 53 and 54**

1. Place a new gasket in position on the flange; install the body and tighten the 3 screws.

2. Install the auxiliary accelerator pump. First, install the diaphragm with outer gasket, then the spring, cover and screws.

3. Install the acceleration pump beginning with the spring, then the diaphragm, cover, boot and screws.

4. Install the choke opener and connect the linkage.

5. Install the idle up diaphragm and connect the linkage.

6. Install the fuel cut solenoid. Always use a new gasket and new O-ring.

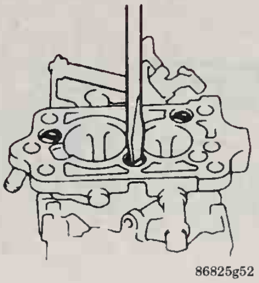


Fig. 48 After placing a new gasket on the flange, tighten the three screws

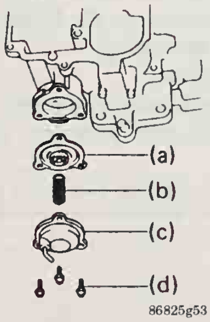

(a)
(b)
(c)
(d)
86825g53

Fig. 49 Install the auxiliary accelerator pump pieces in this order: (a) diaphragm, (b) spring, (c) cover, (d) screws

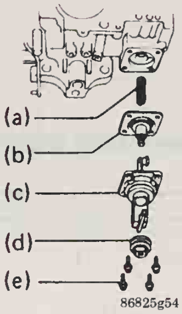

(a)
(b)
(c)
(d)
(e)
86825g54

Fig. 50 Install the acceleration pump pieces in this order: (a) spring, (b) diaphragm with the outer gasket, (c) cover, (d) boot, (e) screws

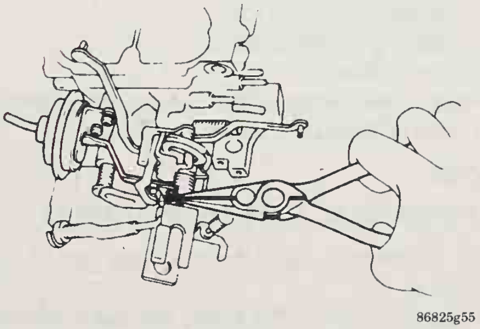


Fig. 51 Needlenose pliers should be used to install the small clip on the linkage

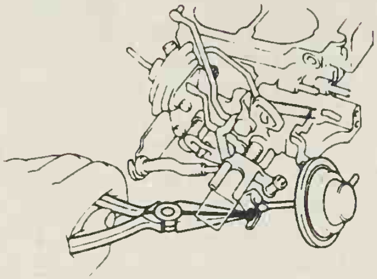


Fig. 52 There is also a small C-clip on the diaphragm linkage

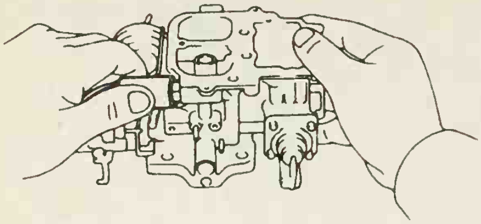


Fig. 53 The solenoid valve screws into the carburetor; be sure to use a new O-ring

7. Install the following:
   - primary main jet (1) over a new gasket
   - plug (2) over a new gasket
   - secondary main jet (3)
   - metering needle guide (4)
   - power valve (5)
8. Place a new O-ring on the slow jet, then using SST 09922-00010 or equivalent, install the slow jet (6).

AIR HORN

➧ See Figures 55, 56, 57, 58, 59, 60, 61 and 62

1. On the air horn, install the outer vent control valve with a new gasket.
2. Place the power piston spring and piston into the bore. While pushing the piston, rotate the retainer over the piston and tighten the retaining screw.
3. In the fuel inlet, install a new gasket and the valve seat. Install the needle valve onto the seat. Insert the lip of the float under the wire of the needle valve. Install the float and secure it with the pivot pin.
4. Adjust the float level, using the procedure listed separately in this section.
5. Put a new gasket on the body and install the air horn. When installing the screws, make certain to install the external components held by the screws such as the inlet bracket, number plate and wire clamps.
6. Connect the fast idle link and air valve connecting rods.
7. Install the metering needle with a collar. Hook the spring end into the hole. Insert the washer and tighten the screw.
8. Push in the terminal until it is securely locked in the connector plug. Pull on the wire to confirm that it is secure.
9. Adjust the carburetor on the bench, using the various procedures listed in this section.
10. Install the carburetor.
11. Attach all tagged hoses to the unit.
12. Start the engine, then make final adjustments as necessary.

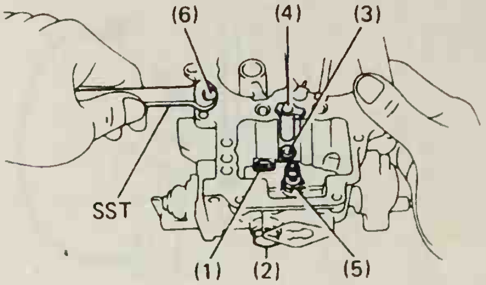


Fig. 54 Location of the primary main jet (1), plug (2), secondary main jet (3), metering needle guide (4), power valve (5), and slow jet (6)

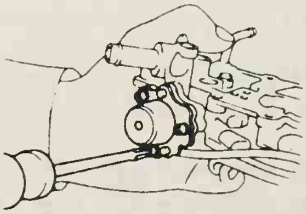


Fig. 55 Tighten the three mounting screws on the outer vent control valve

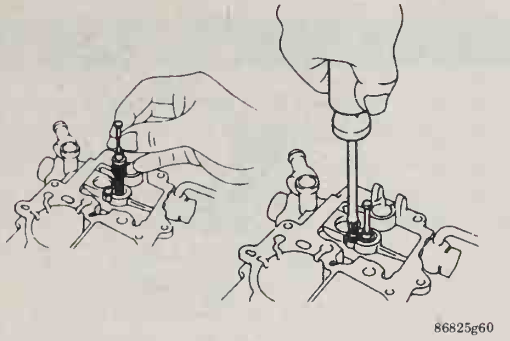


Fig. 56 Place the power piston spring and piston into the bore. While pushing the piston, rotate the retainer over the piston and tighten the retaining screw

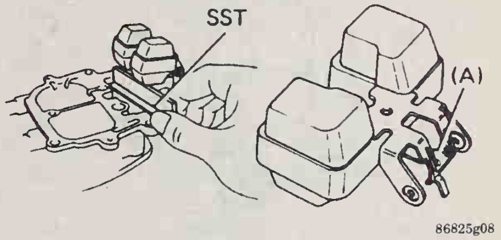

SST
(A)
86825g08

Fig. 58 Bend portion (A) of the float to 0.386 in. (9.8mm)

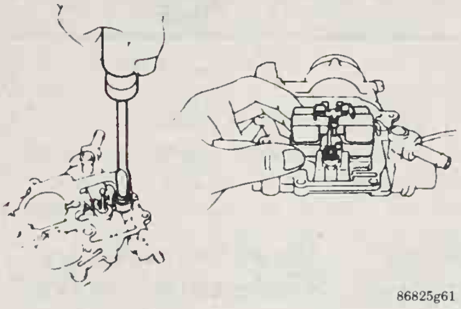


Fig. 57 Install the float and needle valve

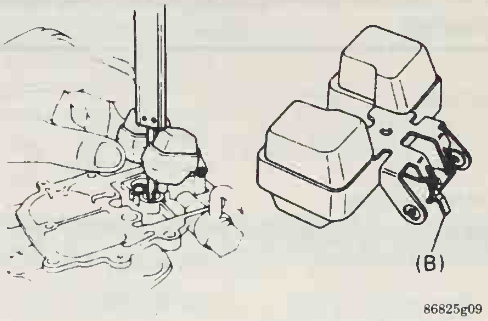


Fig. 59 Bend portion (B) of the float to 1.89 in. (48mm)

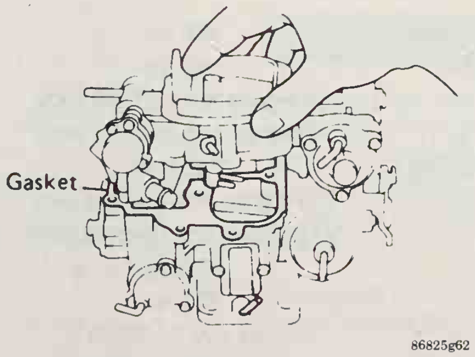

Gasket
86825g62

Fig. 60 Be sure to place the gasket on the body correctly, to ensure that the screws inserted through the air horn are not obstructed

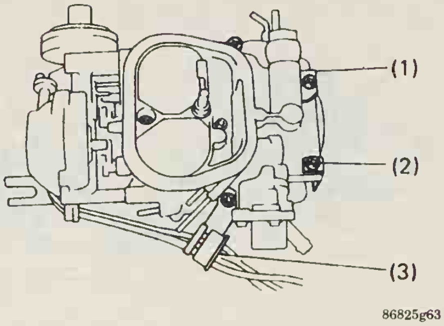


Fig. 61 Install the (1) fuel inlet bracket, (2) number plate, and (3) wire clamp, along with the screws

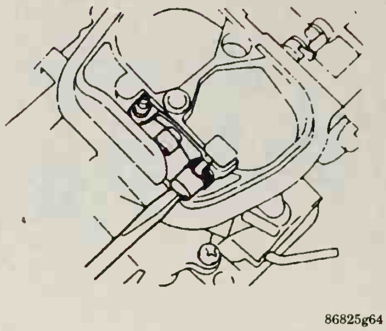


Fig. 62 Tighten the screw after the washer is inserted

CARBURETOR SPECIFICATIONS

Component		U.S.	Metric
Float level			
	Raised position	0.386 in.	9.8mm
	Lowered position	1.89 in.	48mm
Float lip clearance		0.04 in.	1mm
Throttle valve closed angle			
	Primary	9 degrees from horizontal plane	9 degrees from horizontal plane
	Secondary	20 degrees from horizontal plane	20 degrees from horizontal plane
Throttle valve full open angle			
	Primary	90 degrees from horizontal plane	90 degrees from horizontal plane
	Secondary	90 degrees from horizontal plane	90 degrees from horizontal plane
Secondary touch angle		59 degrees from horizontal plane	59 degrees from horizontal plane
Fast idle angle			
	Federal and Canada	24.5 degrees from horizontal plane	24.5 degrees from horizontal plane
	California	23 degrees from horizontal plane	23 degrees from horizontal plane
Fast idle speed			
	Federal and Canada	3000 rpm	3000 rpm
	California	2600 rpm	2600 rpm
Unloader angle		45 degrees from horizontal plane	45 degrees from horizontal plane
Choke breaker opening angle		42 degrees from horizontal plane	42 degrees from horizontal plane
Choke heater resistance	at 68 deg F (20 deg C)	20-22 ohms	20-22 ohms
Idle-up angle		16.5 degrees from horizontal plane	16.5 degrees from horizontal plane
Dashpot touch angle		24.5 degrees from horizontal plane	24.5 degrees from horizontal plane
Dashpot setting speed		3000 rpm	3000 rpm
Idle speed		700 rpm	700 rpm
Idle mixture adjusting screw presetting		screw-out 3 1/2 turns	screw-out 3 1/2 turns
Idle mixture speed		740 rpm	740 rpm

86825c55

MULTI-PORT FUEL INJECTION

General Information

Most of the Toyota trucks that are covered by this manual are equipped with Multi-Port Electronic Fuel Injection system. The Electronic Fuel Injection System is particularly good because it requires no venturi restriction. That means that it has a greater capacity for total power than an equivalent carburetor since air flows through it more freely.

Also, carburetors are limited in their ability to accurately measure airflow because they do not compensate for changes in barometric pressure or temperature, and cannot accurately and quickly respond to throttle changes. This system overcomes those limitations.

Additionally, by injecting the fuel with nearly 40 psi (275 kPa) pressure right at the intake ports, the engine is fed a more consistently atomized mixture with the injection system. This improves performance and fuel economy, especially during cold engine operation.

The heart of the system is a fuel supply loop which consists of a fuel pump and damper which supply fuel under a relatively smooth and constant pressure through a filter. Fuel is supplied to a loop which passes by each fuel injector (one for each cylinder). The loop returns to the fuel tank via a pressure regulator which measures the pressure or vacuum (depending upon throttle opening) that exists in the intake manifold. The pressure regulator, by precisely controlling the return of fuel to the tank, maintains pressure in the fuel line at 38-44 psi (265-304 kPa) above the pressure in the intake manifold.

Each fuel injector consists of a nozzle and a tiny electric solenoid valve. The system employs electronics to determine how long the solenoid should be open each time it inputs fuel. By varying the electric pulse sent to the injector and, therefore, the time each injector stays open, the system can precisely supply the amount of fuel the engine requires. For example, if the driver should open the throttle and double the amount of airflow to the engine, the injectors would stay open twice as long as before the driver accelerated. Air entering into the system flows through the air cleaner, and then enters the air flow meter. This device measures the flow of air through a precisely designed flap, which opens or closes with airflow against the tension of a spring. A temperature measuring device compensates for the increased density of cold air.

From here, the air passes into the throttle body. This part contains the throttle which controls airflow according to the driver's demands, much the same as in an ordinary carburetion system. There are switches which tell the electronic microprocessor which controls the system when the truck is at full throttle or at idle, for appropriate changes in fuel/air mixture. When the driver releases the throttle pedal, the throttle body closes off entirely, and air for engine idle is routed through the auxiliary air valve to the engine.

Whenever there is a change in airflow, it is reflected as a change in the air flow meter's signal to the microprocessor and a change in the width (or time) of the pulse the microprocessor sends to the injectors.

The system is extremely complex and requires specialized training and equipment to fully service and repair. You can, however, make a few simple checks and adjustments, provided you adhere to the safety precautions in this section.

FUEL DELIVERY

The MFI system supplies the optimum air/fuel mixture to the engine under all various operating conditions. System fuel, is injected into the intake air passage of the cylinder head. The amount of fuel injected is controlled by the intermittent injection system where the electromagnetic injection valve (fuel injector) opens only for a short period of time, depending on the amount of air required for 1 cycle of operation. During system operation, the amount injected is determined by the duration of an electric pulse sent to the fuel injector, which permits precise metering of the fuel.

All the operating conditions of the engine are converted into electric signals, resulting in additional features of the system, such as improved adaptability and easier addition of compensating element. The MFI system also incorporates the following features:

- Reduced emission of exhaust gases
- Reduction in fuel consumption
- Increased engine output
- Superior acceleration and deceleration
- Superior starting and warm-up performance in cold weather since compensation is made for coolant and intake air temperature

Safety Precautions

- Do not connect the battery, or jumper cables, with reverse polarity.
- Never disconnect the battery while the engine is running.
- Turn **OFF** the ignition switch before disengaging any connector in the system.
- Keep all connectors dry.
- If handling electronic parts, do not drop them or permit them to be banged against another part while removing or installing them.

Relieving Fuel System Pressure

To relieve the fuel pressure, wrap a clean towel or rag around either the cold start injector fitting or the union bolt (banjo bolt) at the fuel delivery rail. Slowly loosen the bolt holding the fuel line and allow pressurized fuel to escape into the rag. Do NOT allow fuel to spray from the fitting; always wrap it in a rag.

➡Pressure may also be relieved at the fuel filter if desired. Tighten the union bolt.

Electric Fuel Pump

All Toyota fuel-injected vehicles are equipped with an electric fuel pump. The pump is located inside the fuel tank. For a fuel injection system to work properly, the pump must develop pressures well above those of a mechanical fuel pump. This high pressure is maintained within the lines even when the engine is not running. Extreme caution must be used to safely release the pressurized fuel before any work is begun.

✳✳CAUTION

Always relieve the fuel pressure within the system before any work is begun on any fuel component. Failure to safely relive the pressure may result in fire and/or serious injury.

REMOVAL & INSTALLATION

▶ See Figures 63, 64, 65, 66, 67 and 68

1. Disconnect the negative battery cable.
2. Safely relieve the fuel pressure within the system. Drain the fuel from the tank, then remove the fuel tank.
3. Remove the pump retaining bolts, then pull the fuel pump bracket up and out of the fuel tank.
4. Remove the gasket from the bracket.
5. Remove the two nuts and then disconnect the wires at the fuel pump.
6. Pull the fuel pump out of the lower side of the bracket. Disconnect the pump from the fuel hose.
7. Remove the rubber cushion and the clip. Disconnect the fuel pump filter from the pump.

To install:

8. Install the fuel pump filter to the pump.
9. Insert the outlet port of the fuel pump into the fuel hose.
10. Install the rubber cushion to the lower side of the fuel pump.
11. Push the lower side of the fuel pump (and the rubber cushion) into the pump bracket.
12. Using a new gasket, position the bracket on the fuel tank and then install and tighten the seven mounting bolts to 30-35 inch lbs. (3-4 Nm).
13. Install the fuel tank.
14. Add gas to the fuel tank.
15. Start the engine, then check for any loose connections or leaks.

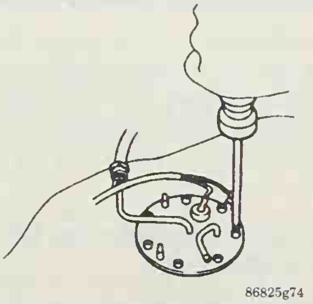


Fig. 63 Unbolt the fuel pump bracket from the fuel tank

TESTING

▶ See Figure 69

1989-95 Models

1. Turn the ignition switch to the **ON** position, but don't start the engine.
2. With a jumper wire, connect terminals B+ and FP of the Data Link Connector (DLC1). This should cause the fuel pump to run; check that there is pressure in the fuel return line from the pressure regulator. You should also hear fuel return noises.
3. Turn the ignition switch **OFF** and remove the jumper wire. If the fuel pump did not function or if there was no pressure in the line, check the fuses, links, EFI main relay, ECM and wiring connections.

1996 Models

2RZ-FE AND 3RZ-FE ENGINE

1. To check the fuel pump operation:
   a. Remove the fuse cover on the instrument panel.
   b. Connect the Toyota hand-held tester or its equivalent scan tool to the Data Link Connector (DLC3).

➡Do not start the engine.

   c. Turn the ignition switch **ON** and push the tester main switch on.
   d. On the Toyota tester select the active test mode.
   e. Refer to the tester instructions for further details.
   f. If you do not have a Toyota hand-held tester, connect the positive and negative leads from the battery to the fuel pump connector.
   g. Check that there is pressure in the fuel inlet hose from the fuel filter. If there is pressure, you will hear the sound of fuel flowing.
   h. If there is no pressure, check the following:
      - M-fuse (AM2 30A)
      - Fuses (EFI 15A, IGN 7.5A)
      - EFI main relay
      - Fuel pump
      - ECM
      - Wiring connections
   i. Turn the ignition switch to **LOCK**.
   j. Disconnect the Toyota hand-held tester from the DLC3.
2. Check the fuel pressure.
   a. Disconnect the negative cable from the battery.
   b. Wrap a shop towel around the delivery pipe, then slowly loosen the union bolt holding the fuel pipe to the delivery pipe and gasket.
   c. Install the SST 09268-45012 (pressure gauge) or its equivalent to the delivery pipe with the two gaskets and the SST (union and union bolt). Tighten to 22 ft. lbs. (29 Nm).
   d. Be sure to wipe off any spilled fuel.
   e. Attach the Toyota hand-held tester or equivalent scan tool to the DLC3.

➡DO NOT start the engine!

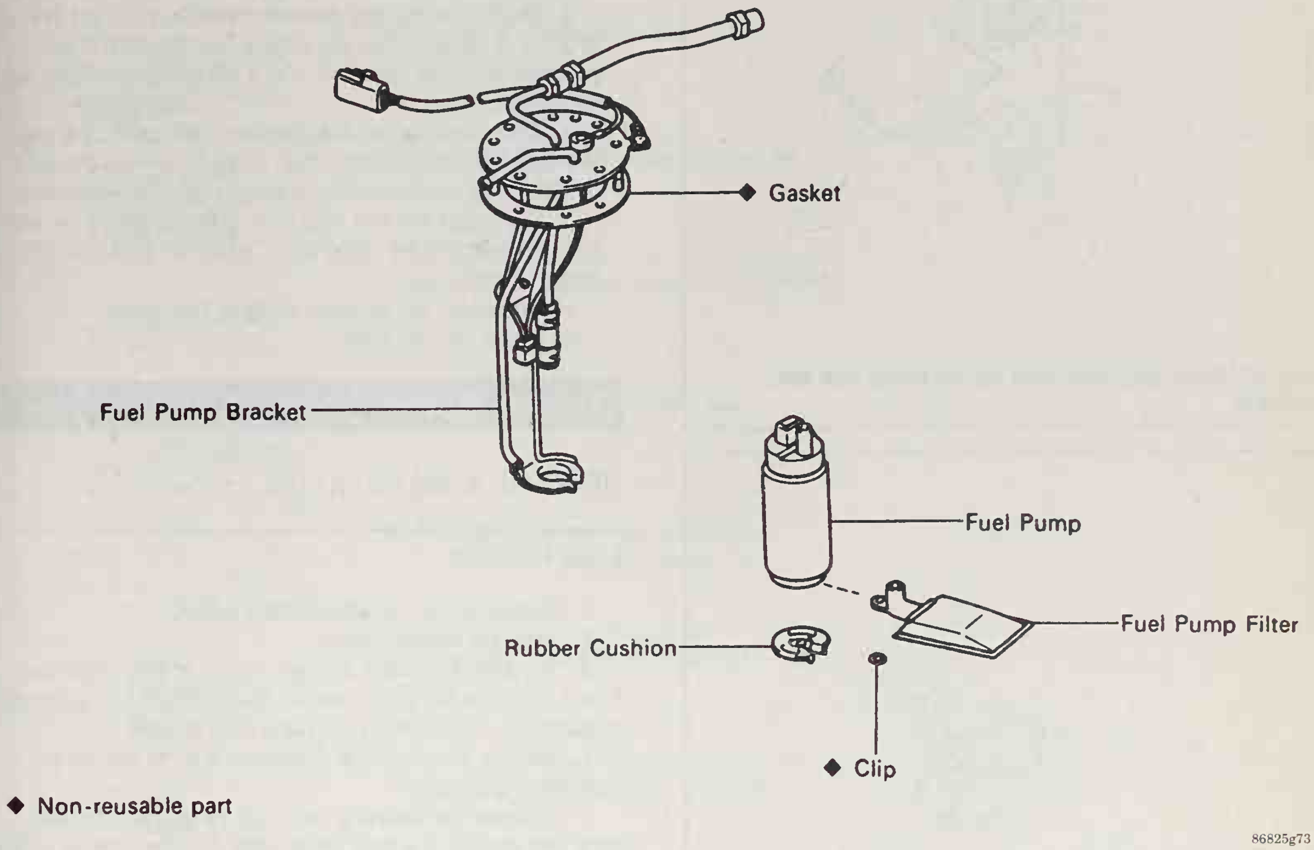

◆ Gasket
Fuel Pump Bracket
Fuel Pump
Fuel Pump Filter
Rubber Cushion
◆ Clip
◆ Non-reusable part
86825g73

Fig. 64 The electric fuel pump has a filter; check it for any clogging or tears

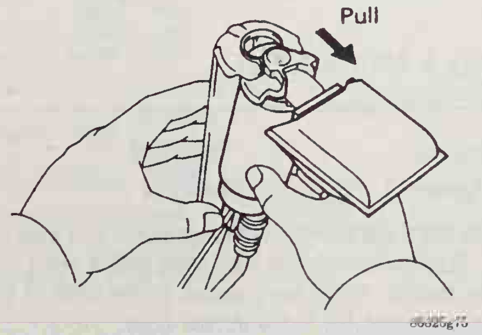

Pull
86825g75

Fig. 65 The pump should can be pulled from the lower side of the bracket in most cases

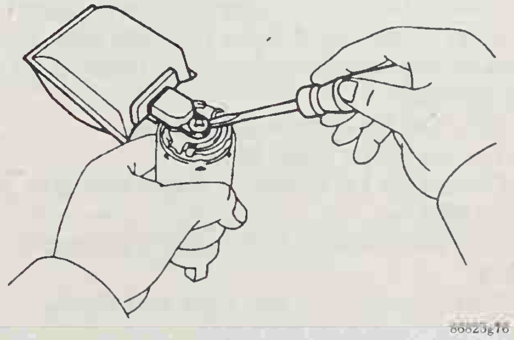


Fig. 66 The filter has a retaining clip; pry it off to separate the filter and pump

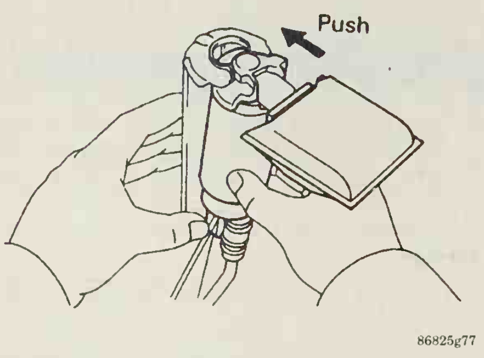


Fig. 67 **Push the lower side of the pump into the bracket**

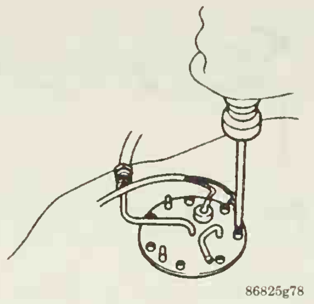


Fig. 68 **Before tightening the mounting bolts, make sure the gasket is in place so there are no gaps**

f. Turn the ignition switch **ON** and push the tester main switch on.

g. On the Toyota tester select the active test mode.

h. Refer to the tester instructions for further details.

i. If you do not have a Toyota hand-held tester, connect the positive and negative leads from the battery to the fuel pump connector.

j. Reconnect the negative battery cable.

k. Turn the ignition switch **ON**.

l. Measure the fuel pressure, it should read 38-44 psi (265-304 kPa).

m. If the pressure is too high, replace the pressure regulator.

n. If the pressure is too low, check the following:

- Fuel connections and hoses
- Fuel pump
- Fuel filter
- Pressure regulator
- Injectors

o. Disconnect the tester from the DLC3.

p. Start the engine.

q. Measure the fuel pressure at idle. It should read 31-37 psi (206-255 kPa). If the pressure is not as specified, check the sensing hose and pressure regulator.

r. Stop the engine.

s. Check that the fuel pressure remains at 21 psi (147 kPa) for 5 minutes after the engine has stopped. If the pressure is not as specified, check the pump, pressure regulator and/or injectors.

t. After checking the fuel pressure, disconnect the negative cable from the battery, then carefully remove the SST 09268-45012 or equivalent, to prevent gas from splashing.

u. Reconnect the fuel inlet pipe to the delivery pipe with new gaskets and the union bolt. Tighten to 22 ft. lbs. (29 Nm).

v. Reconnect the negative cable to the battery.

w. Check for fuel leaks.

Throttle Body

REMOVAL & INSTALLATION

▸ See Figure 70

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Tag and disconnect all lines, hoses or wires that lead from the throttle body. On models equipped with an automatic transmission, disconnect the throttle control cable.
4. Remove the air intake connector and the air cleaner hose with resonator.
5. Unscrew the mounting bolts and remove the throttle body and gasket. The cast metal parts may be cleaned with a soft brush and carburetor solvent. If possible, use low pressure compressed air to blow out the passages and tubing.

To install:

6. Install the throttle body using a new gasket, then tighten the mounting bolts 9-13 ft. lbs. (12-18 Nm).
7. Connect the air cleaner hose with resonator and the air intake connector.
8. Reconnect all lines, hoses and wires.
9. Fill the engine with coolant and connect the battery cable.

TESTING & ADJUSTMENT

22R-E Engine

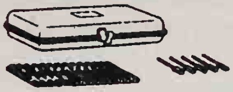
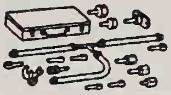
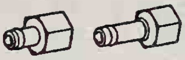
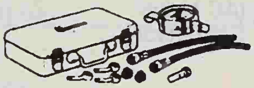
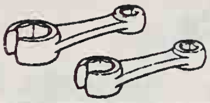
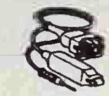
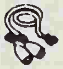
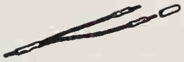
▸ See Figures 71, 72, 73, 74, 75 and 76

1. With the throttle body off the vehicle, clean prior to inspection. Wash and clean the cast parts with a soft brush in carburetor cleaner. Using compressed air, clean all of the passages and apertures in the throttle body.

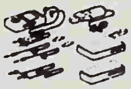
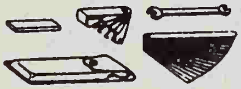
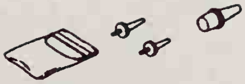
➡To prevent any damage, do not clean the throttle position sensor.

2. Check that there is no clearance between the throttle stop screw and the throttle lever when the throttle valve is fully closed.

SST (SPECIAL SERVICE TOOLS)

	09240−00020	Wire Gauge Set	Throttle body
	09268−41045	Injection Measuring Tool Set	
	(09268−52010)	Injection Measuring Attachment	
	09268−45012	EFI Fuel Pressure Gauge	
	09631−22020	Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842−30050	Wire "A" EFI Inspection	
	09842−30070	Wiring "F" EFI Inspection	
	09843−18020	Diagnosis Check Wire	

RECOMMENDED TOOLS

	09082−00050	TOYOTA Electrical Tester Set.	
	09200−00010	Engine Adjust Kit .	
	09258−00030	Hose Plug Set .	Plug for the vacuum hose, fuel hose etc.

86825gb3

Fig. 69 Toyota special service tools for most fuel injected engines

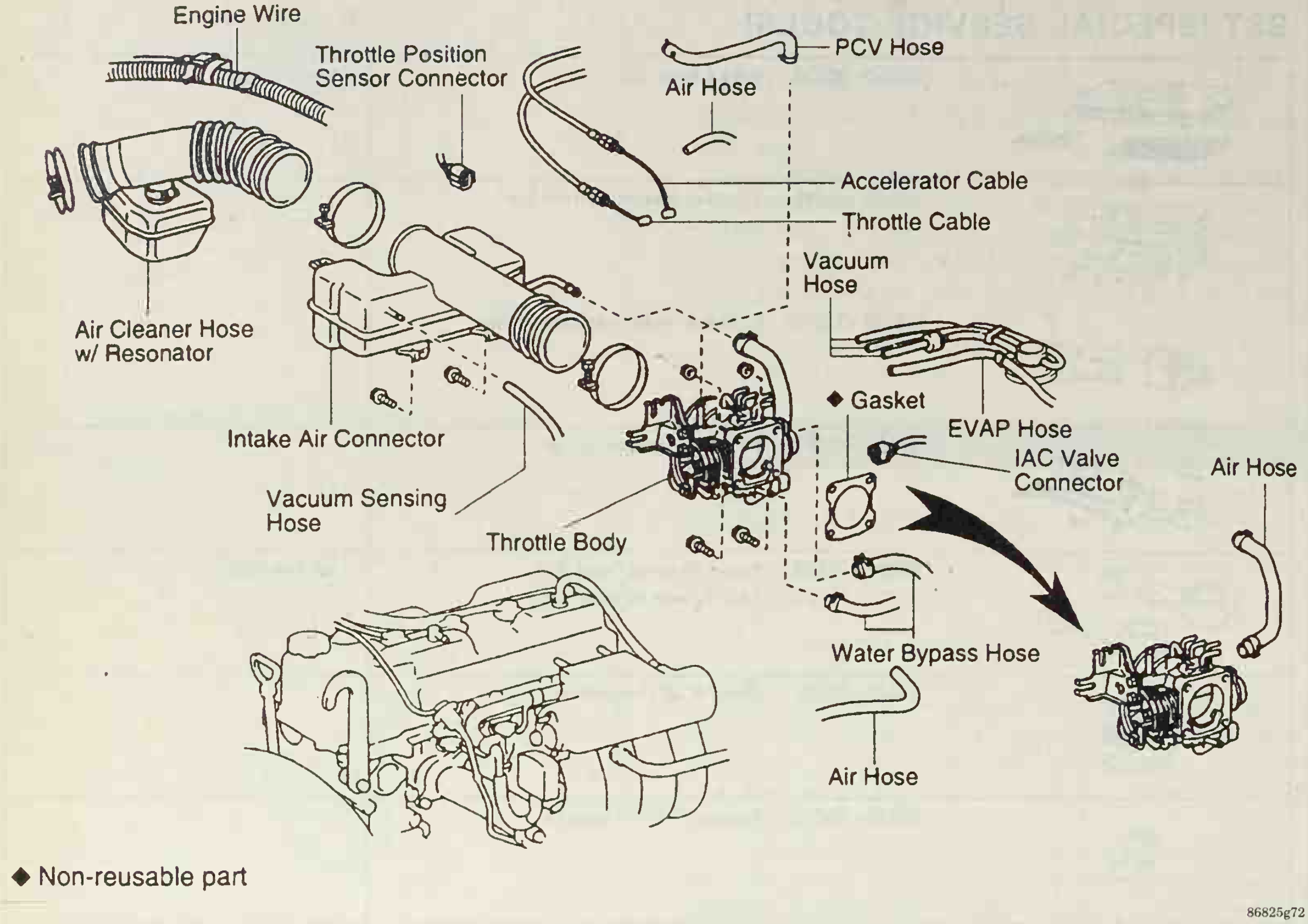

Engine Wire
Throttle Position Sensor Connector
PCV Hose
Air Hose
Accelerator Cable
Throttle Cable
Vacuum Hose
Air Cleaner Hose w/ Resonator
◆ Gasket
EVAP Hose
IAC Valve Connector
Air Hose
Intake Air Connector
Vacuum Sensing Hose
Throttle Body
Water Bypass Hose
Air Hose
◆ Non-reusable part
86825g72

Fig. 70 Exploded view of the throttle body and related components — 3RZ-FE shown

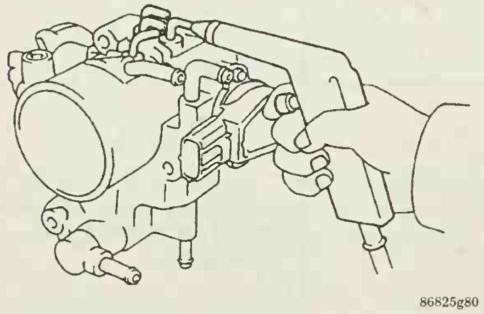


Fig. 71 Using compressed air, clean the passages and apertures of the throttle body

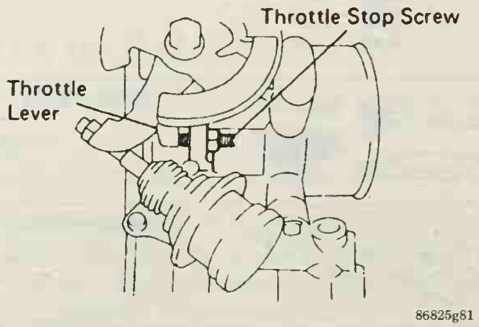

Throttle Stop Screw
Throttle Lever
86825g81

Fig. 72 Locations of the throttle lever and stop screw

3. Check the position sensor.

4. If necessary, adjust the throttle position sensor by loosening the 2 screws of the sensor. Insert a 0.0276 in. (0.70mm) gauge between the throttle stop screw and the lever. Connect the ohmmeter to the terminals IDL and E2 of the sensor.

5. Slowly turn the sensor clockwise until the ohmmeter deflects, then secure the sensor with the screws. Using the thickness gauge, recheck the continuity between the two terminals.

3VZ-E Engine

ON VEHICLE

➧ See Figures 77, 78, 79, 80, 81, 82, 83 and 84

1. Check the the throttle linkage moves smoothly.
2. Check the vacuum at each port:
   a. Start the engine.
   b. Pull each line off one at a time and check the vacuum with your finger.

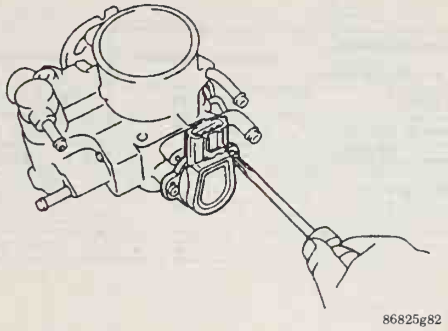


Fig. 73 Loosen the throttle positioner screws

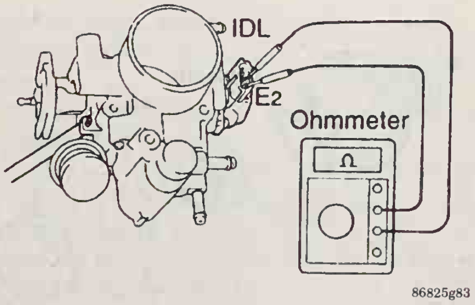


Fig. 74 Insert a 0.70mm gauge between the throttle stop screw and the lever. Connect the ohmmeter to terminals IDL and E2 of the sensor

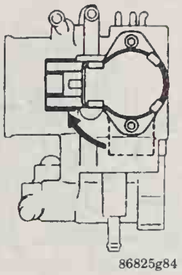


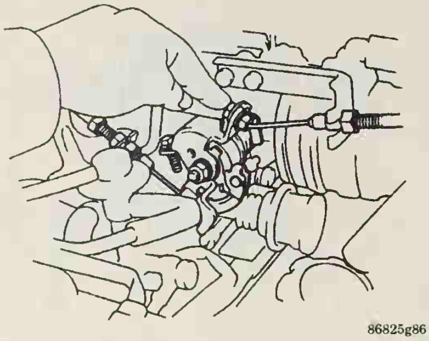
Fig. 75 Slowly turn the sensor clockwise until the ohmmeter deflects

Clearance between lever and stop screw	Continuity (IDLE – E_2)
0.57 mm (0.0224 in.)	Continuity
0.85 mm (0.0335 in.)	No continuity

86825g85

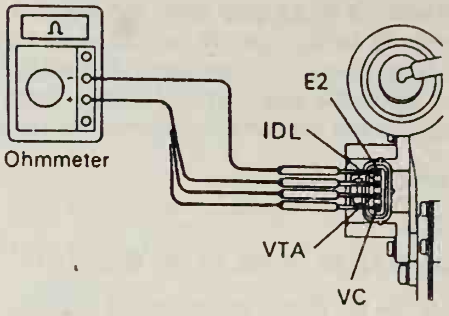
Fig. 76 Insert the appropriate gauge to check for proper adjustment

3. Inspect the throttle position sensor by applying vacuum to the throttle opener. Unplug the sensor connection, then insert a 0.0244 in. (0.62mm) gauge or SST 09240-00020, between the throttle stop screw and the stop lever. With the aid of an ohmmeter, measure the resistance between each terminal.
4. Reconnect the sensor.
5. Inspect the dashpot, warm-up the engine to normal operating temperature.
6. Check the idle speed and adjust, if necessary.
7. Remove the cap, filter and separator from the dashpot.
8. Check and adjust the dashpot setting speed:
   a. Maintain engine speed of 2500 rpm or more.
   b. Plug the Vacuum Transmitting Valve (VTV) hole with your finger.
   c. Release the throttle valve, then check that the dashpot is set to 1800-2200 rpm.
   d. If it is not as specified, adjust with the dashpot adjusting screw.



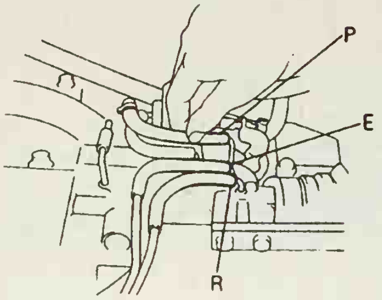
86825g86

Fig. 77 Check the smoothness of the throttle linkage



86825g89

Fig. 80 Measure the resistance between each of the terminals on the throttle position sensor



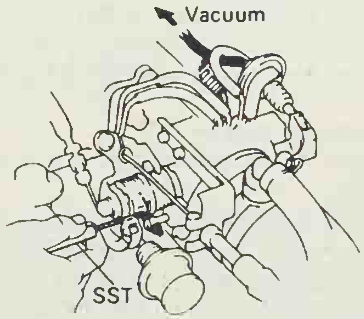
86825g87

Fig. 78 With the engine running, pull each of these vacuum lines off one at a time, then check for vacuum with your finger

Clearence between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.47 – 6.1 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.80 mm (0.031 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	3.1 – 12.1 kΩ
–	VC – E2	3.9 – 9.0 kΩ

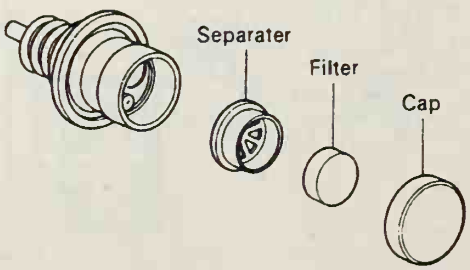
86825g90

Fig. 81 Insert the appropriate gauge to check for proper adjustment



86825g88

Fig. 79 As you apply vacuum to the throttle opener, insert a gauge or SST 09240-00020 between the throttle stop and the stop lever



86825g91

Fig. 82 Exploded view of the dashpot assembly

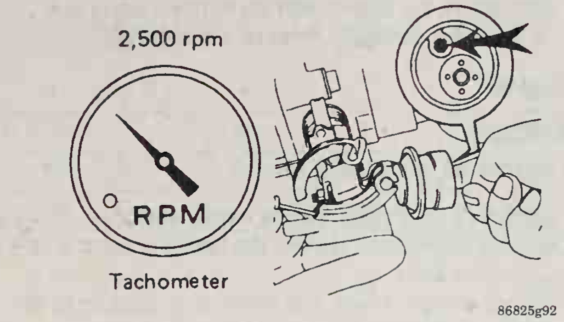


Fig. 83 Check and adjust the dashpot setting speed; maintain the engine speed at 2500 rpm or more

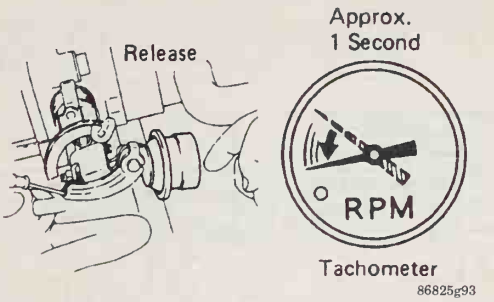


Fig. 84 Within one second, the rpm should drop once your finger is removed from the Vacuum Transmitting Valve (VTV) hole

9. Check the operation of the Vacuum Transmitting Valve (VTV) by setting the dashpot speed in the same procedure as above:
   a. Maintain engine speed of 2500 rpm or more.
   b. Plug the Vacuum Transmitting Valve (VTV) hole with your finger.
   c. Release the throttle valve, then check that the dashpot is set to 1800-2200 rpm.
   d. Remove your finger from the hole and check that the engine returns to idle speed in approximately 1 second.
10. Install the dashpot separator, filter and cap.
11. Inspect the throttle opener by allowing the engine to warm up. Check the idle speed.
12. Check the throttle opener seating speed by disconnecting the vacuum hose from the opener, then plug the hose end.
13. Maintain the idle speed at 2500 rpm.
14. Release the throttle valve, then check that the opener is set, 900-1800 rpm. If the speed is not as specified, replace the throttle body assembly.
15. Reconnect the vacuum hose to the opener.
16. Inspect the air valve operation by fully screwing in the idle speed adjusting screw.
    a. At low temperature, while the screw is in, the engine speed should drop.
    b. After warm-up, while the screw is in, the engine speed should drop below idle speed stop.

OFF VEHICLE

1. With the throttle body off the vehicle, clean prior to inspection. Wash and clean the cast parts with a soft brush in carburetor cleaner. Using compressed air, clean all of the passages and apertures in the throttle body.

➡To prevent any damage, do not clean the throttle position sensor.

2. Apply vacuum to the throttle opener.
3. Check that there is no clearance between the throttle stop screw and the throttle lever when the throttle valve is fully closed.
4. Check the position sensor.
5. Apply vacuum to the throttle opener.
6. Insert a gauge between the throttle stop screw and the lever. Connect the ohmmeter to measure the resistance between each terminal.
7. Reconnect the sensor harness.
8. If necessary, adjust the throttle position sensor by loosening the 2 screws of the sensor.
9. Apply vacuum to the throttle opener.
10. Insert a gauge 0.024 in. (0.60mm) between the throttle stop screw and the lever. Connect the ohmmeter to measure the resistance between terminals IDL and E2 of the sensor.
11. Slowly turn the sensor clockwise until the ohmmeter deflects, then secure the sensor with the screws. Using the gauge, recheck the continuity between the two terminals.

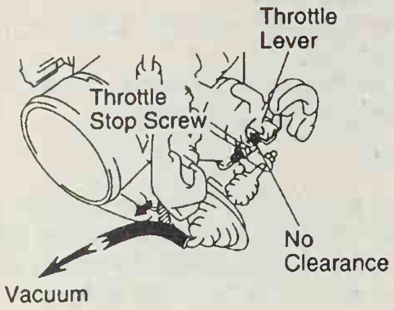
2RZ-FE and 3RZ-FE Engine

➧ See Figures 85, 86, 87 and 88

1. With the throttle body off the vehicle, clean prior to inspection. Wash and clean the cast parts with a soft brush in carburetor cleaner. Using compressed air, clean all of the passages and apertures in the throttle body.

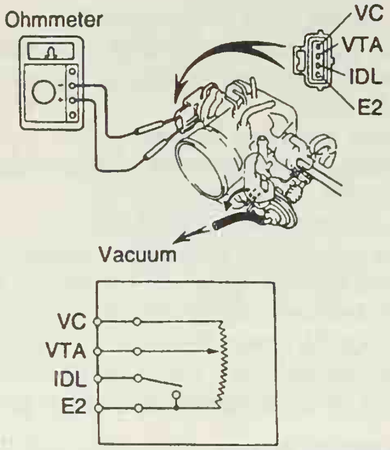
➡To prevent any deterioration, do not clean the throttle position sensor.

2. Apply vacuum to the throttle opener.
3. Check that there is no clearance between the throttle stop screw and the throttle lever when the throttle valve is fully closed.
4. Check the position sensor.
5. Apply vacuum to the throttle opener.
6. Insert a gauge between the throttle stop screw and the lever. Connect the ohmmeter to measure the resistance between each terminal.
7. Reconnect the sensor harness.
8. If necessary, adjust the throttle position sensor by loosening the 2 screws of the sensor.
9. Apply vacuum to the throttle opener.
10. Insert a gauge 0.026 in. (0.65mm) between the throttle stop screw and the lever. Connect the test probe of the ohm-



86825ga1

Fig. 85 When applying vacuum to the throttle opener, ensure that there is no clearance between the throttle stop and throttle lever



86825ga2

Fig. 86 With an ohmmeter, measure the resistance between each terminal of the throttle position sensor

Clearence between lever end stop screw	Between terminels	Resistence
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.57 mm (0.022 in.)	IDL – E2	2.3 kΩ or less
0.74 mm (0.029 in.)	IDL – E2	Infinity
Throttle velve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

86825ga3

Fig. 87 Insert the appropriate gauge to check for proper adjustment of the throttle position sensor on the 2RZ-FE and 3RZ-FE engines

meter to measure the resistance between terminals IDL and E2 of the sensor.

11. Slowly turn the sensor clockwise until the ohmmeter deflects, then secure the sensor with the screws. Using the gauge, recheck the continuity between the terminals.

3F-E Engine

ON VEHICLE

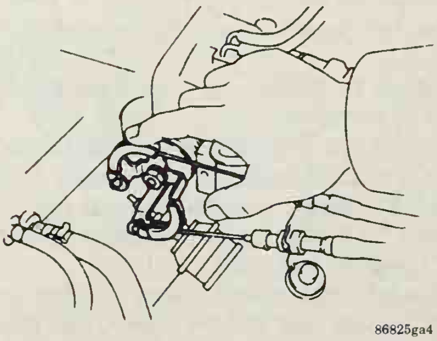
➧ See Figures 89, 90, 91 and 92

1. Check that the throttle linkage moves smoothly.
2. Start the engine and remove the hose(s) one at a time from the vacuum port.
3. With your finger, check that there is no vacuum at idle and that there is vacuum at anything other than idle.
4. Unplug the electrical connector from the throttle position sensor.
5. Insert a flat feeler gauge between the throttle stop screw and the stop lever.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.57 mm (0.022 in.)	Continuity
0.74 mm (0.029 in.)	No continuity

86825gj9

Fig. 88 Insert the appropriate gauge to check for proper adjustment of the lever and stop screw



86825ga4

Fig. 89 Using your finger, slide the linkage back and forth to check movement

Port No.	At idling	Other than idling
EGR	No vacuum	Vacuum
R	No vacuum	Vacuum

86825ga5

Fig. 90 The results of the vacuum testing at the EGR and R ports should be as indicated

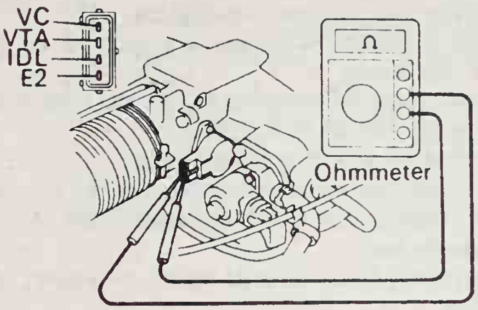


Fig. 91 Attach an ohmmeter to the terminals and check the resistance of the throttle position sensor

6. Using an ohmmeter, check the continuity between each terminal on the sensor.
7. Reconnect the sensor harness.

OFF VEHICLE

1. With the throttle body off the vehicle, clean prior to inspection. Wash and clean the cast parts with a soft brush in carburetor cleaner. Using compressed air, clean all of the passages and apertures in the throttle body.

➡To prevent any deterioration, do not clean the throttle position sensor.

2. Apply vacuum to the throttle opener.
3. Check that there is no clearance between the throttle stop screw and the throttle lever when the throttle valve is fully closed.
4. Check the position sensor.
5. If necessary, adjust the throttle position sensor by loosening the 2 screws of the sensor.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.3 – 6.3 kΩ
0.77 mm (0.0303 in.)	IDL – E2	Less than 2.3 kΩ
1.09 mm (0.0429 in.)	IDL – E2	Infinity
Throttle valve fully opened position	VTA – E2	3.5 – 10.3 kΩ
—	VC – E2	4.25 – 8.25 kΩ

86825ga7

Fig. 92 Clearance and resistance specifications for the 3F-E idle stop and lever

6. Insert a gauge 0.0366 in. (0.93mm) between the throttle stop screw and the lever. Connect the test probe of the ohmmeter to measure the resistance between terminals IDL and E2 of the sensor.
7. Slowly turn the sensor clockwise until the ohmmeter deflects, then secure the sensor with the screws. Using the thickness gauge, recheck the continuity between the two terminals.
8. Inspect the dashpot, warm-up the engine to normal operating temperature.
9. Check the idle speed and adjust, if necessary.
10. Disconnect the ISC harness.
11. Remove the cap, filter and separator from the dashpot.
12. Check and adjust the dashpot setting speed:
    a. Maintain engine speed of 2500 rpm or more.
    b. Plug the Vacuum Transmitting Valve (VTV) hole with your finger.
    c. Release the throttle valve, then check that the dashpot is set to 1200 rpm.
    d. If it is not as specified, adjust with the dashpot adjusting screw.
13. Check the operation of the VTV by setting the dashpot speed in the same procedure as above:
    a. Maintain engine speed of 2500 rpm or more.
    b. Plug the VTV hole with your finger.
    c. Release the throttle valve, then check that the dashpot is set to 1200 rpm.
    d. Remove your finger from the hole and check that the engine returns to idle speed in approximately 1 second.
14. Install the dashpot separator, filter and cap.
15. Reconnect the ISC harness.

Fuel Injectors

OPERATION

There is one fuel injector for each cylinder and a cold start injector which provides additional fuel during start-up. The injectors spray fuel into the intake port, in front of the intake valve. When the injector is energized, the coil pulls the plunger up, opening the needle valve and allowing the pressurized fuel to pass through the injector. Injectors operation is controlled by the EFI computer. The injectors operate at low pressure and are open for only a fraction of a second at a time.

REMOVAL & INSTALLATION

22R-E, 3VZ-E and 3F-E Engines

1. Disconnect the negative battery cable.
2. Safely discharge the fuel pressure in the system. Place a suitable container under the intake manifold to catch any dripping fuel.
3. On 3VZ-E and 22R-E engines, drain the coolant.
4. Disconnect the accelerator and throttle cable.
5. Remove the air intake chamber. Removal of the throttle body is required on 22R-E engine. On the 3F-E engine, make particularly certain all vacuum hoses and wires are labeled; they are numerous.
6. Tag and disconnect all hoses and wires which interfere with injector removal.
7. On 3VZ-E and 3F-E engines, the main engine wiring harness must be moved out of the way. This will require unplugging various connectors at components on the engine until the harness can be repositioned. Label everything before disconnecting it.
8. Unplug the wiring connectors from the tops of the fuel injectors and remove the two plastic clamps that hold the wiring harness to the fuel delivery pipe.
9. For the 22R-E and 3F-E engines, disconnect the fuel line to the fuel delivery rail. Carefully remove the fuel rail (with the injectors attached) from the engine. Do not allow the injectors to fall out during removal.
10. For the 3VZ-E engine, disconnect the vacuum hose from the Bimetal Vacuum Switching Valve (BVSV). Remove the four union bolts and Nos. 2 and 3 fuel pipes. Pull the injectors from the delivery pipes.

To install:

11. Insert new insulators into the injector holes on the intake manifold.
12. Install the grommet and a new O-ring to the delivery pipe end of each injector.
13. Apply a thin coat of gasoline to the O-ring on each injector and then press them into the delivery pipe. Make absolutely certain the injector is squarely and firmly mounted in the pipe; it must not be crooked.
14. Install the injectors together with the delivery pipe in the intake manifold. Tighten the mounting bolts to 11-15 ft. lbs. (15-20 Nm). Once installed, make sure the injectors turn freely in their mounts. If one doesn't turn, remove the injector and check the O-ring.
15. Clip the wiring harness into the delivery pipe and then plug the wiring connectors to the top of each injector.
16. Reconnect all hoses and wires.
17. Install the throttle body and air intake chamber.
18. If the throttle body was removed, refill the engine coolant. Connect the battery cable.
19. Start the engine and check for any fuel leaks.

2RZ-FE and 3RZ-FE Engines

1. Disconnect the negative battery cable.
2. Safely discharge the fuel pressure in the system. Place a suitable container under the intake manifold to catch any dripping fuel.
3. Remove the throttle body.
4. Unplug the four injector connectors, crankshaft position sensor and knock sensor connectors.
5. Disconnect the Data Link Connector (DLC1) and wire clamp from the brackets.
6. Remove the delivery pipe and injectors from the engine.
7. Disconnect the vacuum sensing hose from the fuel pressure regulator.
8. Place a suitable container and a shop rag under and around the delivery pipe to keep the fuel from spurting out. Then slowly loosen the union bolt and 2 gaskets, disconnect the fuel inlet pipe from the delivery pipe.
9. Remove the 2 bolts and the delivery pipe together with the 4 injectors.

➡Be careful not to drop the injectors when you are removing the injector pipe.

10. Remove the 4 insulators from the spacers.
11. Pull out the injectors from the delivery pipe.
12. Remove the O-ring and grommet from each injector.

To install:

13. Install a new grommet to the injector.
14. Apply a light coat of gasoline to the new O-ring, then install it to the injector.
15. While turning the injector to the left and right, install it to the delivery pipe. Install the injectors.
16. Position the injector connector upward.
17. Place the new insulators in position on the spacers. Place the injectors together with the delivery pipe into position on the cylinder head.
18. Temporarily install the bolts holding the delivery pipe to the head.
19. Check the the injectors rotate smoothly. If they do not, recheck the O-ring installation. Replace the O-rings if necessary.
20. Position the injector upward, then tighten the bolts holding the delivery pipe to the head to 15 ft. lbs. (21 Nm).
21. Connect the fuel inlet pipe to the delivery pipe with new gaskets and the union bolt. Tighten to 22 ft. lbs. (29 Nm).
22. Attach the fuel return hose to the pressure regulator.
23. Attach the vacuum sensing hose to the pressure regulator.
24. Connect the engine harness.
25. Install the throttle body.
26. Fill the cooling system, attach the negative battery cable.

TESTING

➧ See Figures 93, 94 and 95

Proper testing of the fuel injectors requires specific equipment not usually available outside a dealership. It is recommended that any checking or testing of the injectors, other than that included in this section, be left to a properly equipped service facility.

Injector operation can be checked with the injectors installed in the engine. A sound scope, which is a stethoscope-like device available from most auto tool and parts jobbers, is recommended, although a piece of good rubber hose will suffice.

With the engine running or cranking, check each injector for normal operating noise (a buzzing or humming), which changes in proportion to engine rpm. If a sound scope is not available to you, check injector operation by touching each injector with your finger. It should be buzzing. If no sound or an unusual sound is heard, check the wiring connector, or have the injector checked professionally.

With the engine **OFF**, measure injector resistance by unplugging the wiring connector from the injector, and connecting an ohmmeter across the injector terminals. Check the continuity at both terminals; resistance should be: cold 12-16 ohms. Resistance will vary with injector temperature.

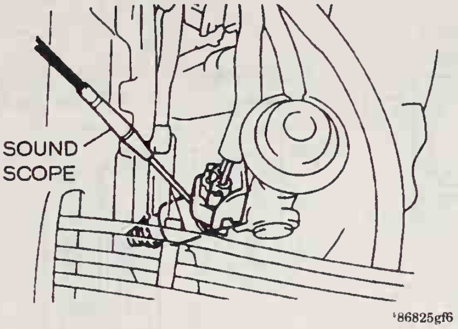


Fig. 93 A sound scope is usually used to inspect injector operation

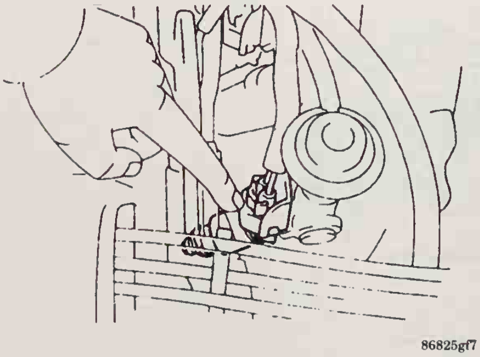


Fig. 94 If a sound scope is not available, check the operation with your finger

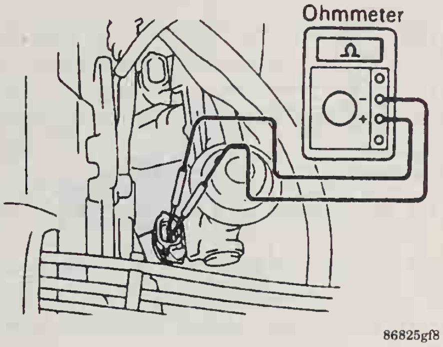


Fig. 95 An ohmmeter is used to check injector resistance

Cold Start Injector

OPERATION

During cold engine starting, the cold start injector is used to supply additional fuel to the intake manifold to aid in initial start-up. The opening and closing of the injector is determined by the start injector time switch. When the engine coolant temperature falls below a certain point, the switch opens the cold start injector. As the engine coolant warms up, the switch will close the injector.

TESTING

➧ See Figures 96 and 97

1. Disconnect the cold start injector wiring.
2. Using an ohmmeter, check the resistance of the injector; the reading should be 2-4 ohms.
3. If the reading does not come within specifications, replace the cold start injector.
4. Attach the cold start injector wiring.

REMOVAL & INSTALLATION

➧ See Figure 98

1. Disconnect the negative battery cable.
2. Safely relieve the fuel pressure. Remove the cold start injector union bolt(s) on the delivery pipe. Before removing the union bolt, place a suitable container and shop towel under it to catch any escaping fuel.
3. Disconnect the wiring at the injector.
4. Unscrew the mounting bolts and then remove the cold start injector from the air intake chamber.

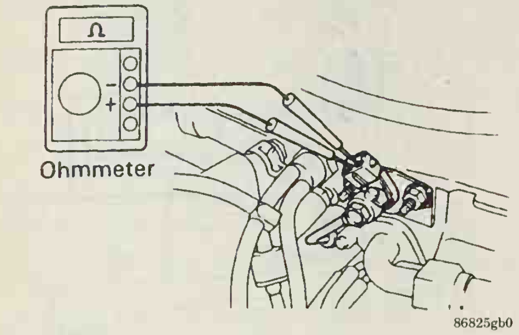


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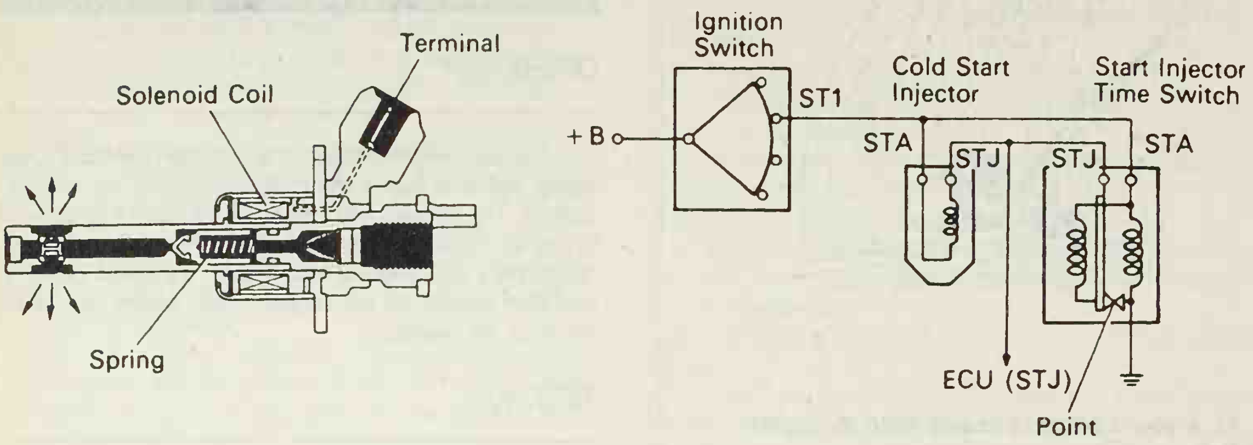
Fig. 96 With the aid of an ohmmeter, check the resistance of the cold start injector

To install:

5. Using a new gasket, install the cold start injector into the intake chamber. Tighten the mounting bolts to between 48-69 inch lbs. (5-8 Nm).
6. Connect the wiring to the injector.
7. Attach the delivery pipe to the injector.
8. Connect the negative battery cable.

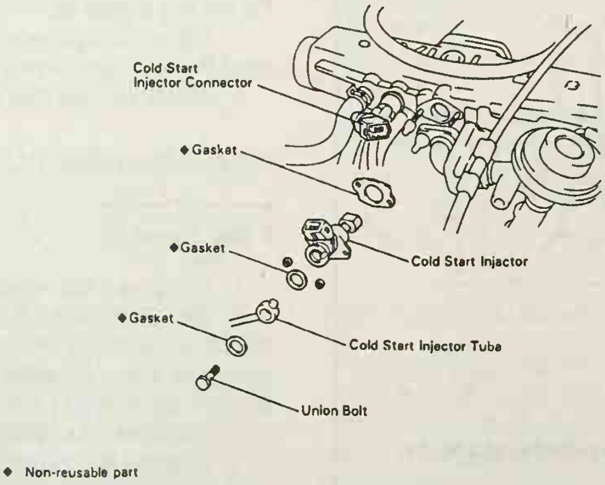
➡Always use a new gasket when reinstalling the injector.

9. Start the engine and check for any leaks.


Terminal
Solenoid Coil
Spring
Ignition Switch
+B
ST1
Cold Start Injector
STA
STJ
STJ
STA
Start Injector Time Switch
ECU (STJ)
Point

86825gb2

Fig. 97 Cross-sectional view and wiring diagram of the cold start injector system


Cold Start Injector Connector
◆Gasket
◆Gasket
◆Gasket
Cold Start Injector
Cold Start Injector Tube
Union Bolt
◆ Non-reusable part

86825gb1

Fig. 98 Exploded view of the cold start injector — 3VZ-E engine shown

Fuel Pressure Regulator

REMOVAL & INSTALLATION

3VZ-E Engine

➧ See Figures 99, 100, 101, 102, 103, 104 and 105

1. Label all hoses and wiring being removed.
2. Drain the engine cooling system.
3. Disconnect these cables:
    - If equipped, cruise control and actuator cable with bracket
    - Accelerator cable
    - Throttle cables on automatic transmissions
4. Disconnect the air cleaner hose.
5. Unhook the vacuum sensing hose.
6. Place a suitable container or shop towel under the fuel pressure regulator. Disconnect the fuel return hose from the regulator.
7. Remove the air intake chamber:
    a. Disconnect the throttle position sensor wiring.
    b. Disconnect the canister vacuum hose from the throttle body.
    c. Disconnect the PCV hose from the union bolt.
    d. Remove the No. 4 water bypass hose from the union of the intake manifold.
    e. Detach the No. 5 water bypass hose from the water bypass pipe.
    f. Unhook the cold start injector connection.
    g. Remove the union bolt, the 2 gaskets and the injector tube.
    h. Disconnect the vacuum hose from the gas filter.
    i. Disconnect the EGR gas temperature sensor wiring.
    j. Remove the intake chamber stay and throttle cable bracket.
    k. Remove EGR valve with pipes and discard of the two gaskets.
    l. Disconnect the No. 1 air hose from the PAIR reed valve.
    m. Detach the 4 vacuum hoses from the air pipes.

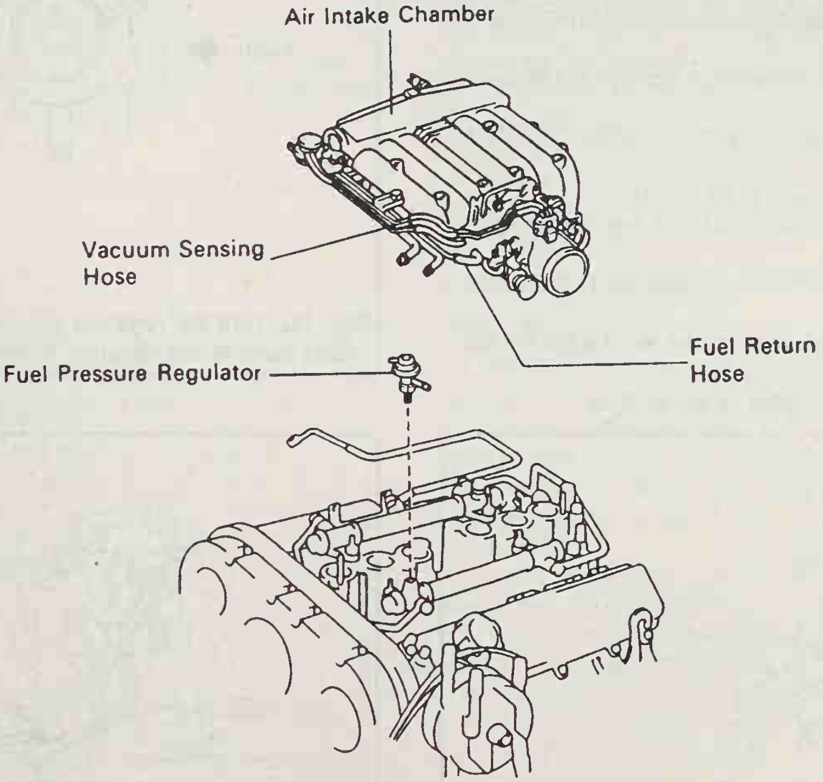


Fig. 99 Location of the fuel pressure regulator — 3VZ-E engine

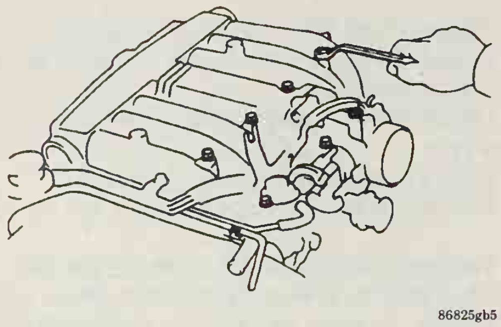


Fig. 100 Unbolt the intake chamber from the engine once all the lines have been disconnected

n. Remove the bolts securing the accelerator cable, then remove the cable.

o. Unbolt the intake chamber and discard of the gasket.

8. Loosen the locknut, then remove the fuel pressure regulator.

To install:

9. Fully loosen the locknut of the pressure regulator, then apply a light coat of gasoline to the new O-ring. Install; the O-ring onto the regulator.

10. Thrust the fuel pressure regulator completely into the the delivery pipe by hand.

11. Turn the regulator counterclockwise until the outlet faces in the direction indicated.

12. Tighten the locknut to 22 ft. lbs. (29 Nm).

13. Install the intake chamber, position a new gasket on the intake manifold.

14. Attach the intake chamber and tighten to 13 ft. lbs. (18 Nm).

15. Install the accelerator cable bracket and tighten the two bolts.

16. Connect the vacuum hoses to the air pipes.

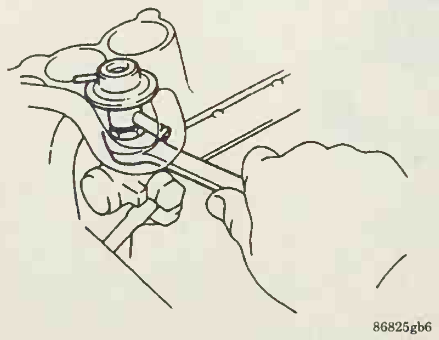


Fig. 101 With the correct size wrench, loosen the regulator

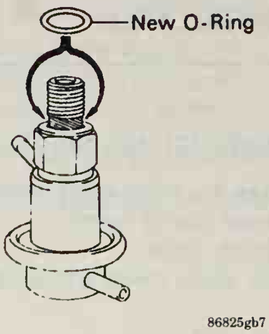


Fig. 102 With the aid of gasoline as a lubricant, install the new O-ring

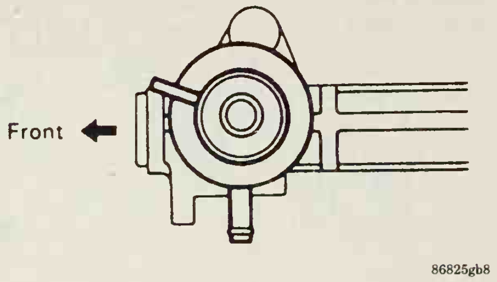


Fig. 103 Turn the regulator counterclockwise until the outlet faces in the direction indicated

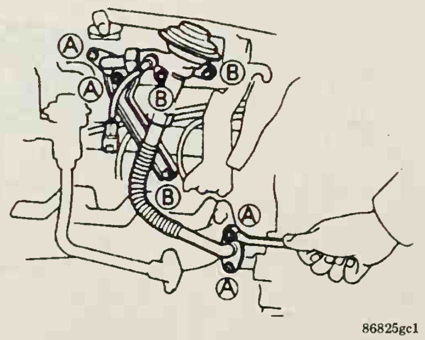


Fig. 104 Position new gaskets on the valve and intake, then tighten the mounting bolts as specified: "A" to 22 ft. lbs. (29 Nm), and "B" to 13 ft. lbs. (18 Nm)

17. Connect the No. 1 air hose to the reed valve.
18. Position 2 new gaskets to the intake chamber and the right-hand exhaust manifold.
    a. Install the EGR valve with the pipes to the intake chamber and the right-hand exhaust manifold.
    b. Install the air intake chamber stay and throttle cable bracket. Tighten the nuts and bolts A: 22 ft. lbs. (29 Nm) and B:13 ft. lbs. (18 Nm).
    c. Connect the EGR hoses to the air pipe and the EGR vacuum modulator.
    d. Attach the EGR gas temperature wiring.
    e. Connect the vacuum hose to the gas filter.
    f. Connect the cold start injector wiring.
    g. Install the No. 5 bypass hose to the water bypass hose.
    h. Connect the No. 4 water bypass hose to the union of the intake manifold.
    i. Connect the PCV hose to the union.
    j. Attach the canister vacuum hose to the throttle body.
    k. Attach the throttle position sensor wiring.
19. Connect the fuel return hose.
20. Connect the vacuum sensing hose.
21. Attach the air cleaner hose.
22. Connect theses cables:

- On models with cruise control, the actuator cable with bracket
- Accelerator cable
- Throttle cables on automatic transmissions

23. To check for fuel leakage do the following:
    a. With the ignition switch in the **ON** position, use a special service tool 09843-18020 or its equivalent to connect the terminals of the FP and +B of the DLC1.
    b. Check for a fuel leakage.
    c. Remove the special service tool from the DLC1.

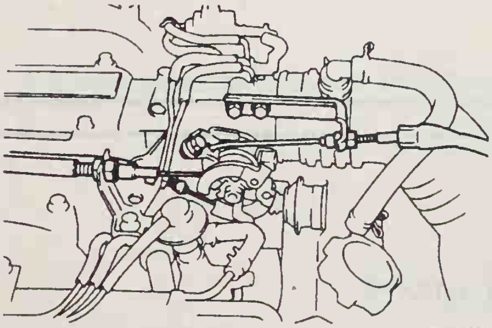


Fig. 105 Attach these cables to their proper locations: throttle, accelerator and cruise control actuator

22R-E Engines

➧ See Figures 106, 107 and 108

1. Disconnect the vacuum sensing hose.
2. Remove the No. 1 EGR pipe.
3. Using a suitable container and shop towel, place them under the regulator. Slowly remove the fuel hose to the regulator.
4. Loosen the locknut, then remove the regulator.

To install:

5. Install the regulator, tighten the locknut to 22 ft. lbs. (29 Nm).
6. Attach the fuel hose.
7. Using a new gasket, attach the No. 1 EGR pipe.
8. Connect the vacuum sensing hose.
9. Check for any fuel leakage.

3F-E Engine

➧ See Figures 108, 109, 110 and 111

1. Disconnect the vacuum sensing hose.
2. Place a suitable container and shop towel under the regulator. Slowly remove the union bolt and discard the gaskets, then disconnect the return pipe.
3. Remove the bolts retaining the regulator, then pull out the unit.

To install:

4. Apply a light coat of gasoline to a new O-ring, then install it onto the regulator.
5. Attach the pressure regulator to the engine, and tighten the bolts to 48 inch lbs. (5 Nm).
6. Using new gaskets, install the return pipe then the union bolt, tighten to 14 ft. lbs. (19 Nm).
7. Connect the vacuum sensing hose.
8. Check for any fuel leakage.

2RZ-FE and 3RZ-FE Engines

➧ See Figures 112 and 113

1. Disconnect the vacuum sensing hose from the pressure regulator.
2. Place a suitable container and shop towel under the regulator, then disconnect the return pipe.
3. Remove the two mounting bolts retaining the regulator to the engine. Discard of the O-ring.

To install:

4. Apply a light coat of gasoline to a new O-ring, then install it onto the regulator.
5. Attach the pressure regulator to the engine, tighten the bolts to 78 inch lbs. (9 Nm).
6. Attach the return pipe to the regulator.
7. Connect the vacuum sensing hose.
8. Check for any fuel leakage.

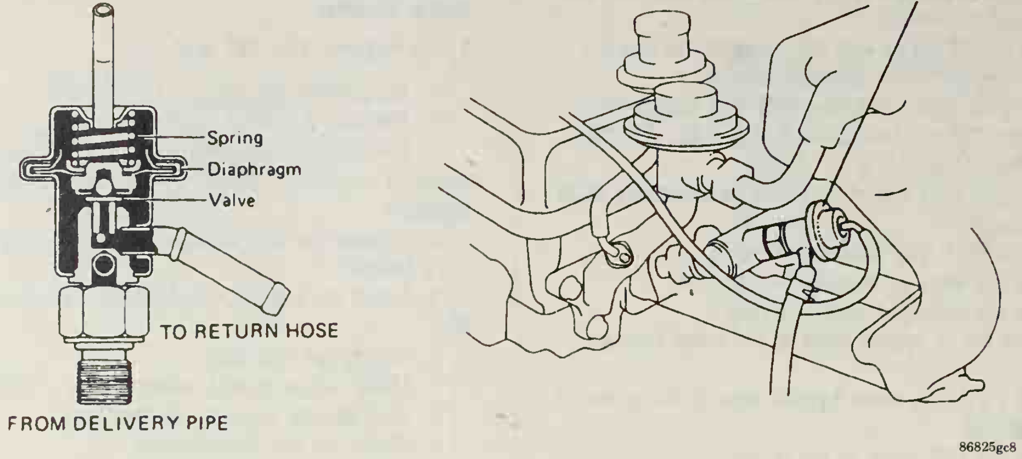

Spring
Diaphragm
Valve
TO RETURN HOSE
FROM DELIVERY PIPE
Pressure Regulator
86825gc8

Fig. 106 Cutaway view of the pressure regulator and location on the 22R-E engine

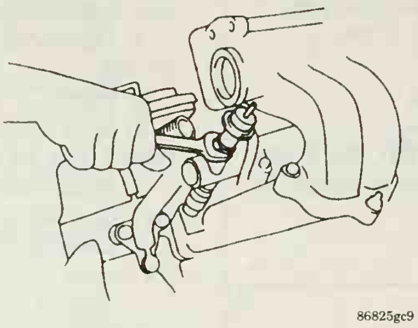


Fig. 107 Loosen the locknut, then remove the regulator

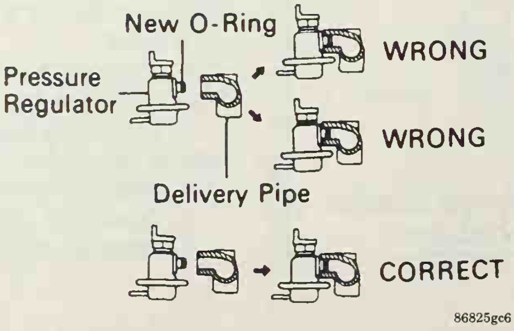

New O-Ring
Pressure Regulator
WRONG
WRONG
Delivery Pipe
CORRECT
86825gc6

Fig. 108 Apply a light coating of gasoline to a new O-ring, then carefully install it onto the regulator

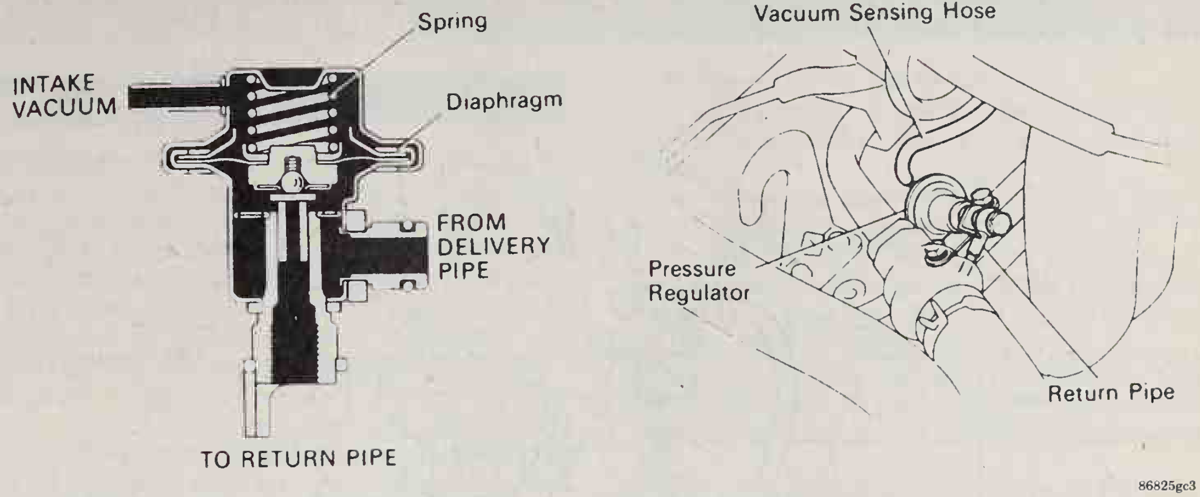

Spring
INTAKE VACUUM
Diaphragm
FROM DELIVERY PIPE
TO RETURN PIPE
Vacuum Sensing Hose
Pressure Regulator
Return Pipe
86825gc3

Fig. 109 Cutaway view of the pressure regulator and location on the 3F-E engine

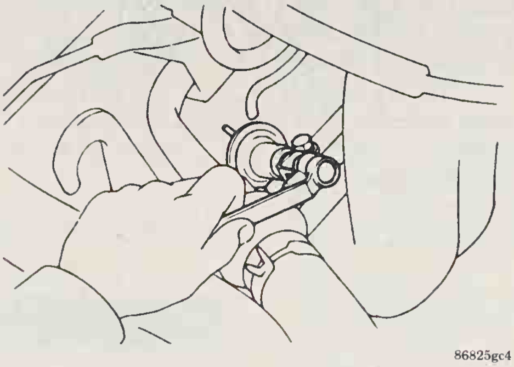


Fig. 110 Slowly remove the union bolt, then disconnect the return pipe

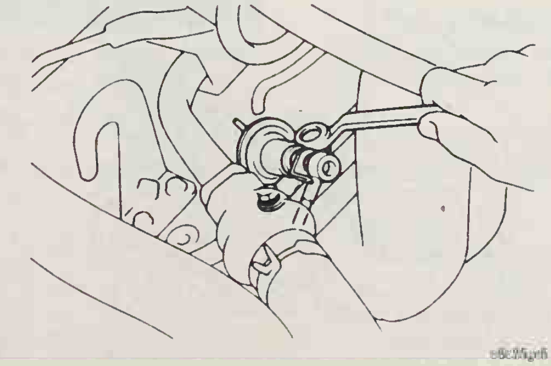


Fig. 111 Remove the two mounting bolts retaining the pressure regulator

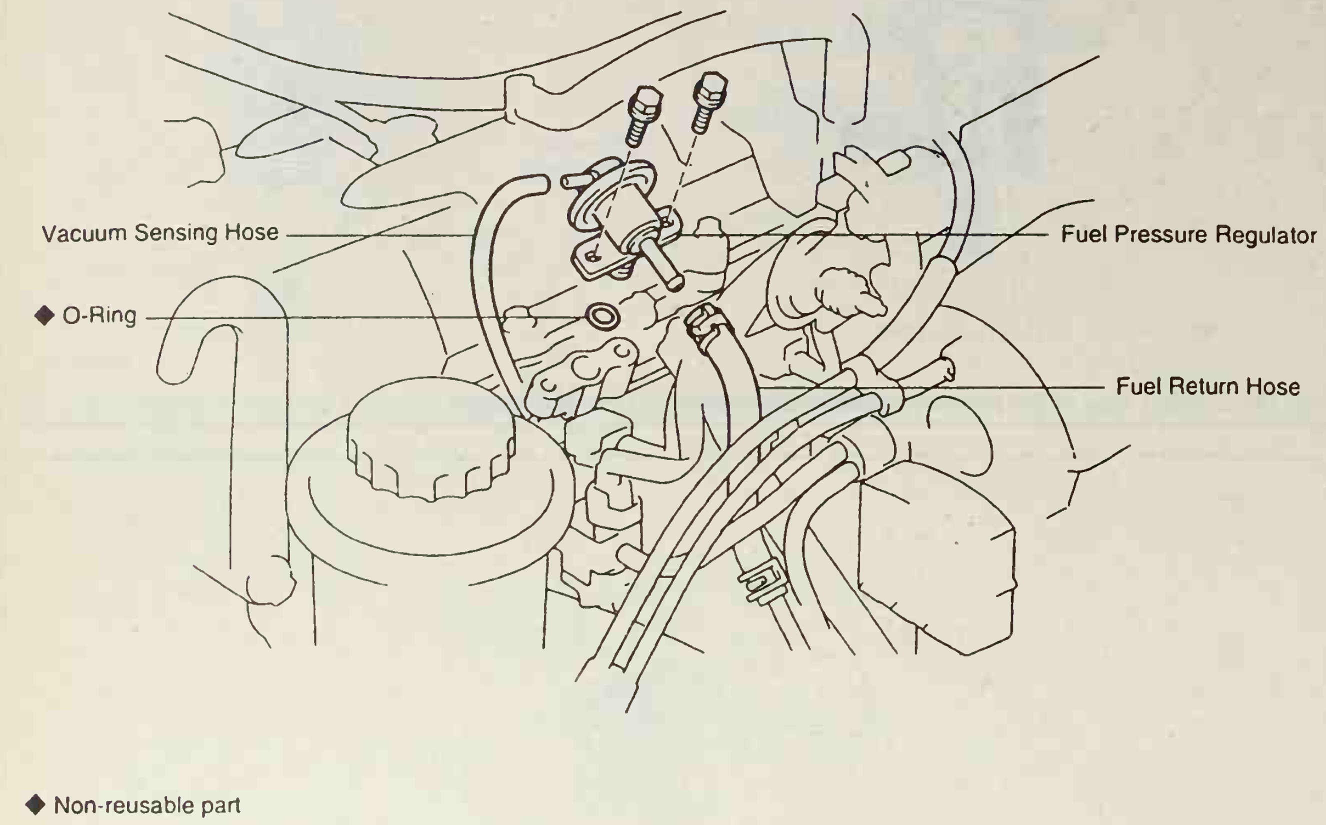

Vacuum Sensing Hose
◆ O-Ring
Fuel Pressure Regulator
Fuel Return Hose
◆ Non-reusable part
86825gd0

Fig. 112 Exploded view of the pressure regulator mounting on the 2VZ-FE and 3VZ-FE engines

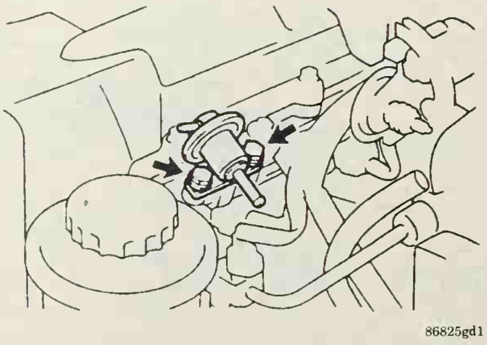


Fig. 113 Tighten the two regulator mounting bolts to 78 inch lbs. (9 Nm) — 2VZ-FE and 3VZ-FE engines

SEQUENTIAL FUEL INJECTION

General Information

Sequential firing of the fuel injectors according to the engine firing order is the most accurate and desirable method of regulating multi-port injection. However, it is also the most complex and expensive to design and manufacture. In this system, the injectors are controlled individually. Each cylinder receives one charge every two revolutions just before the intake valve opens. This means that the mixture is never static in the intake manifold. Along with the mixture adjustments that can be made almost simultaneously between the firing of one injector and the next. A camshaft signal sensor or a special distributor reference pulse informs the ECM when the No. 1 cylinder is on the compression stroke. If the sensor fails or the distributor reference pulse is interrupted in any way, some injector systems shut down, while others revert to pulsing the injectors simultaneously.

Relieving Fuel System Pressure

To relieve the fuel pressure, wrap a clean towel or rag around either the cold start injector fitting or the union bolt (banjo bolt) at the fuel delivery rail. Slowly loosen the bolt holding the fuel line and allow pressurized fuel to escape into the rag. Do NOT allow fuel to spray from the fitting; always wrap it in a rag.

➡Pressure may also be relieved at the fuel filter if desired. Tighten the union bolt.

Electric Fuel Pump

All Toyota fuel-injected vehicles are equipped with an electric fuel pump. The pump is located inside the fuel tank. For a fuel injection system to work properly, the pump must develop pressures well above those of a mechanical fuel pump. This high pressure is maintained within the lines even when the engine is not running. Extreme caution must be used to safely release the pressurized fuel before any work is begun.

⁂CAUTION

Always relieve the fuel pressure within the system before any work is begun on any fuel component. Failure to safely relieve the pressure may result in fire and/or serious injury.

REMOVAL & INSTALLATION

1FZ-FE Engine

▶ See Figures 114, 115, 116, 117, 118, 119 and 120

1. Disconnect the negative battery cable.
2. Remove the rear seats of the vehicle.
3. Remove the scuff plate, side garnish and step plate.
4. Remove the floor mats.
5. Remove the floor service hole cover.
6. Disconnect the fuel pipe and hose from the fuel pump bracket. Disconnect the pump and sensor gauge connection as follows:
    a. Remove the union bolt and gaskets, then disconnect the outer pipe from the pump bracket.
    b. Detach the return hose from the pump bracket.
7. Remove the pump bracket assembly from the gas tank. Discard of the gasket from the pump bracket. Be careful not to bend the arm of the sender gauge.
8. Pull off the lower side of the pump from the pump bracket. Disconnect the pump wiring, then disconnect the fuel hose from the pump. This should release the pump from the unit.
9. With the aid of a flat-bladed tool, remove the clip retaining the filter to the pump. This will allow the filter to slide off the pump.

To install:

10. Attach filter with the C-clip onto the pump.
11. Push the lower half of the pump into the bracket and attach the wiring. Connect the fuel hose to the pump.
12. With all of the pump parts in place on the bracket, slide the unit into the gas tank with a new gasket. Tighten to 35 inch lbs. (4 Nm).
13. Attach the union bolt with new gaskets along with the outlet pipe to the bracket. Tighten to 22 ft. lbs. (29 Nm).
14. Double check that all hoses are secure and that all wiring is intact, then install the service hole cover.
15. Install the floor mats, step plate, side garnish and scuff plate.
16. Install the rear seats, tighten to 29 ft. lbs. (39 Nm).
17. Start the vehicle and check for leaks.

5VZ-FE Engine

1. Remove the fuel tank.
2. Remove the fuel pump bracket or assembly from the tank. Disconnect the pump wiring from the clamp as follows:
    a. Remove the 8 mounting bolts and pull the bracket assembly out of the tank.
    b. Remove and discard of the gasket on the pump bracket.
3. Pull off the lower side of the pump from the pump bracket. Disconnect the pump wiring, then disconnect the fuel hose from the pump. This should release the pump from the unit.
4. With the aid of a flat-bladed tool, remove the clip retaining the filter to the pump. This will allow the filter to slide off the pump.

To install:

5. Attach filter with the C-clip onto the pump.
6. Push the lower half of the pump into the bracket and attach the wiring. Connect the fuel hose to the pump.
7. With all of the pump parts in place on the bracket, slide the unit into the gas tank with a new gasket. Tighten to 35 inch lbs. (4 Nm).
8. Install the fuel tank.
9. Start the vehicle and check for leaks.

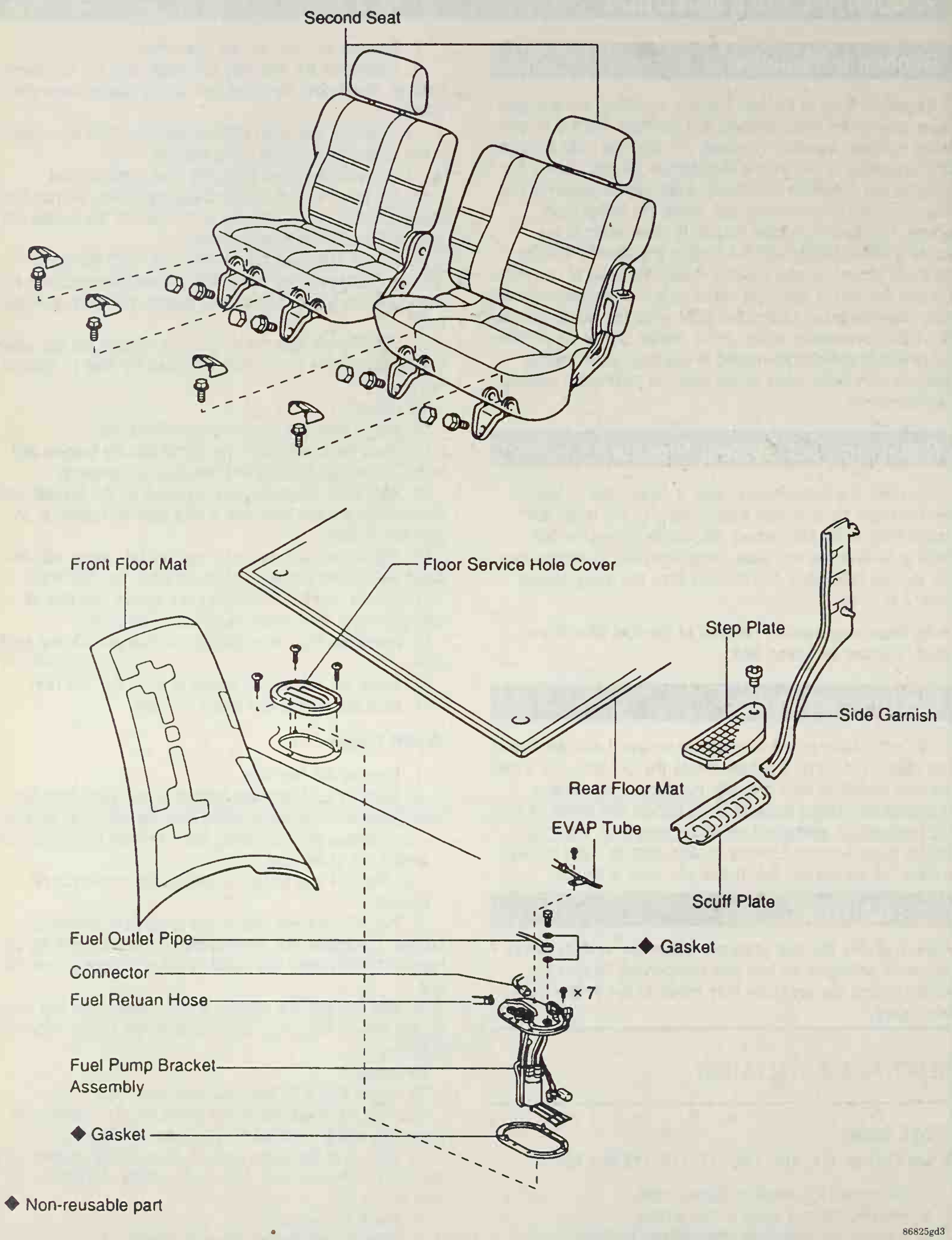

Second Seat
Front Floor Mat
Floor Service Hole Cover
Step Plate
Side Garnish
Rear Floor Mat
EVAP Tube
Scuff Plate
Fuel Outlet Pipe
◆ Gasket
Connector
× 7
Fuel Retuan Hose
Fuel Pump Bracket Assembly
◆ Gasket
◆ Non-reusable part
86825gd3

Fig. 114 The rear seats must be removed to access the fuel pump and sending unit

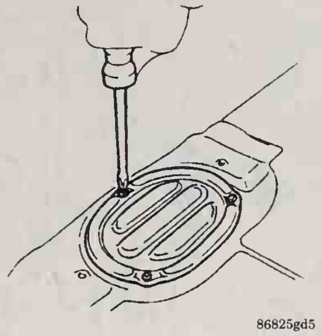


Fig. 115 Loosen and remove the three service hole mounting screws

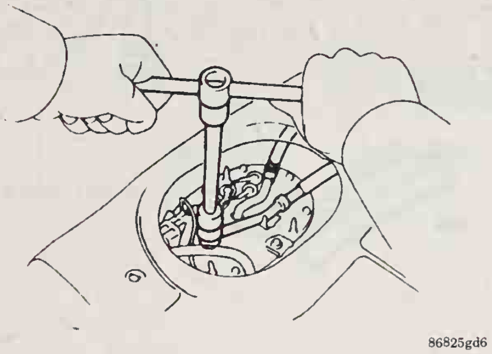


Fig. 116 Remove the union bolt and gaskets, then disconnect the outlet pipe

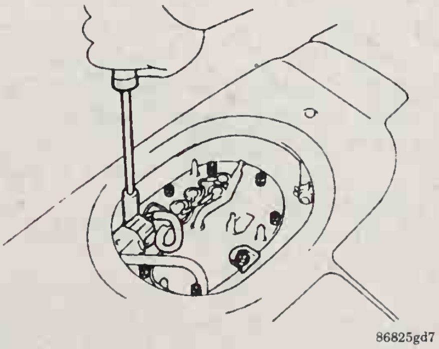


Fig. 117 Remove the 8 bolts holding the fuel pump bracket to the gas tank

TESTING

1FZ-FE Engine

1993-95 MODELS

➧ See Figures 121 and 122

1. Disconnect the battery cables, negative first. Remove the battery from the vehicle.
2. Remove the rear seats.
3. Remove the scuff plate, side garnish, step plate and carpet mats.
4. Remove the floor service hole cover.
5. Disconnect the fuel pump and sender gauge connector.
6. Check the resistance with the aside of an ohmmeter on terminals 5 and 6. The reading should be 0.2-3.0 ohms at 68°F (20°C). If the reading is not within specifications, replace the pump.
7. To inspect the pump operation, connect the positive lead from the battery to terminal 6 of the connector. Attach the negative lead to terminal 5, then check how the pump operates.

➡These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out. Keep the pump away from the battery and always perform switching at the battery side.

8. Reconnect the pump and sender gauge wiring.
9. Reinstall the floor service hole cover, floor mats, step plate, side garnish and scuff plates.
10. Install the rear seats, tighten to 29 ft. lbs. (39 Nm).
11. Reconnect the negative battery cable.

1996 MODELS

➧ See Figure 123

1. Check the fuel pump operation as follows:
   a. Remove the fuse cover on the instrument panel.
   b. Connect the Toyota hand-held tester or its equivalent scan tool to the DLC3.

➡Do not start the engine.

   c. Turn the ignition switch **ON** and push the tester main switch on.
   d. On the Toyota tester select the active test mode.
   e. Refer to the tester instructions for further details.
   f. If you do not have a Toyota hand-held tester, connect the positive and negative leads from the battery to the fuel pump connector.
   g. Check that there is pressure in the fuel inlet hose from the fuel filter. If there is pressure, you will hear the sound of fuel flowing.
   h. If there is no pressure, check the following:
      - Fusible links (MAIN 2.0L, AM2 0.3P)
      - Fuses (EFI 15A, IGN 7.5A)
      - EFI main relay
      - Fuel pump
      - ECM
      - Wiring connections
   i. Turn the ignition switch to LOCK.
   j. Disconnect the Toyota hand-held tester from the DLC3.

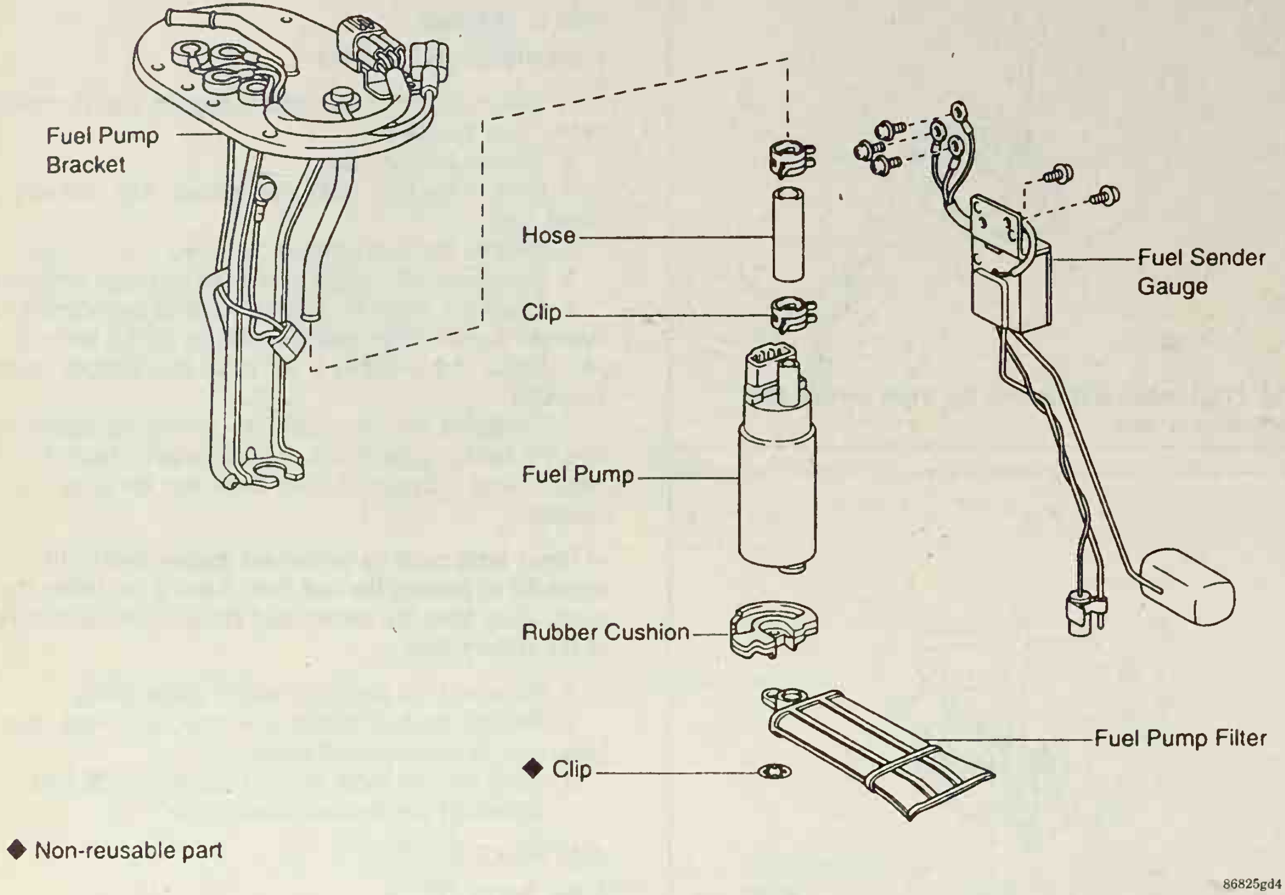

Fuel Pump Bracket
Hose
Clip
Fuel Pump
Rubber Cushion
◆ Clip
Fuel Sender Gauge
Fuel Pump Filter
◆ Non-reusable part
86825gd4

Fig. 118 There are many parts holding the pump, filter and sender to the bracket

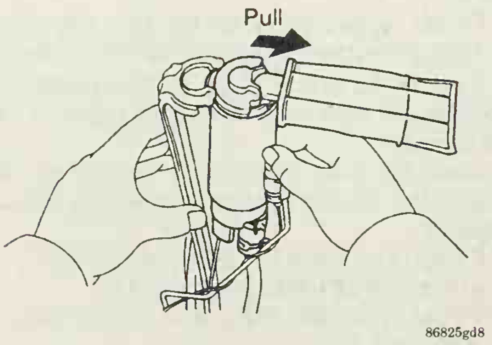

Pull
86825gd8

Fig. 119 Pull the pump in an outward motion from the lower side of the bracket

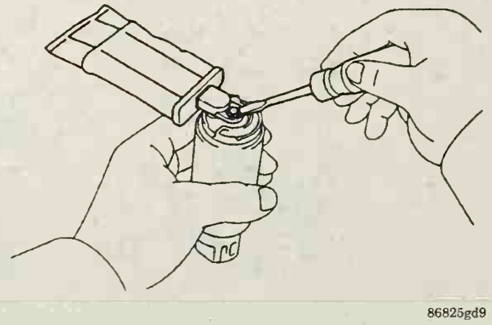


Fig. 120 Carefully release the small C-clip from the filter

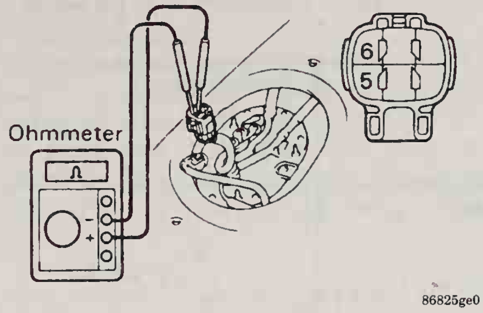


Fig. 121 Measure the resistance across terminals 5 and 6 of the fuel tank sender

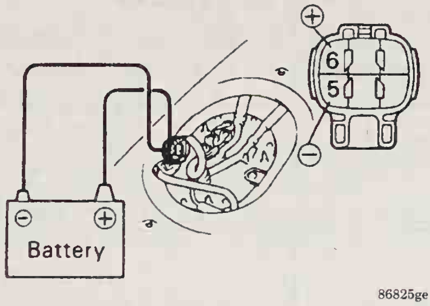


Fig. 122 Use a 12V battery to energize the fuel tank sender by placing the positive lead to terminal 6 and the negative lead to terminal 5

2. Check the fuel pressure as follows:

a. Check the battery positive voltage is above 12 volts.

b. Disconnect the negative cable from the battery.

c. Wrap a shop towel around the delivery pipe, then slowly loosen the union bolt holding the fuel pipe to the delivery pipe and gasket.

d. Install the SST 09268-45012 (pressure gauge) or its equivalent to the delivery pipe with the two gaskets and the SST (union and union bolt). Tighten to 22 ft. lbs. (29 Nm).

e. Be sure to wipe off any spilled fuel.

f. Attach the Toyota hand-held tester or equivalent scan tool to the DLC3. Reconnect the negative cable to the battery.

g. Turn the ignition switch **ON**.

h. Measure the fuel pressure, it should read 38-44 psi (265-304 kPa).

i. If the pressure is too high, replace the pressure regulator.

j. If the pressure is too low, check the following:

- Fuel connections and hoses
- Fuel pump
- Fuel filter
- Pressure regulator

k. Disconnect the tester from the DLC3.

l. Reinstall the fuse box cover on the instrument panel.

m. Start the engine.

n. Disconnect the vacuum sensing hose from the fuel pressure regulator, then plug the hose end.

o. Measure the pressure at idle, 38-44 psi (265-304 kPa).

p. Reconnect the vacuum sensing hose to the fuel pressure regulator.

q. Measure the pressure at idle, 31-37 psi (226-255 kPa). If the pressure is not as specified, check the fuel; pump, pressure regulator and/or injectors.

r. Stop the engine.

s. Check that the fuel pressure remains as specified for 5 minuets after the engine has stopped. 21 psi (147 kPa). If the pressure is not as specified, check the pump, pressure regulator and/or injectors.

t. After checking the fuel pressure, disconnect the negative cable from the battery, then carefully remove the SST 09268-45012 or equivalent, to prevent gas from splashing.

u. Reinstall the fuel pipe with new gaskets and the union bolts, tighten the bolts to 22-25 ft. lbs. (29-34 Nm).

v. Reconnect the negative cable to the battery.

w. Check for fuel leaks.

5VZ-FE Engine

➧ See Figure 123

1. Check the fuel pump operation as follows:

a. Remove the fuse cover on the instrument panel.

b. Connect the Toyota hand-held tester or its equivalent scan tool to the DLC3.

➡Do not start the engine.

c. Turn the ignition switch **ON** and push the tester's main switch on.

d. On the Toyota tester select the active test mode.

e. Refer to the tester instructions for further details.

f. If you do not have a Toyota hand-held tester, connect the positive and negative leads from the battery to the fuel pump connector.

g. Check that there is pressure in the fuel inlet hose from the fuel filter. If there is pressure, you will hear the sound of fuel flowing.

h. If there is no pressure, check the following:

- H-fuse (ALT 80)
- M-fuse (AM1 40A, AM2 30A)
- Fuses (EFI 15A, IGN 7.5A)
- EFI main relay
- Fuel pump
- ECM
- Wiring connections

i. Turn the ignition switch to **LOCK.**

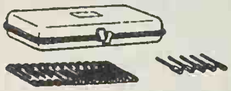
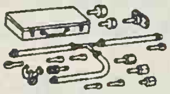
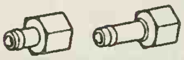
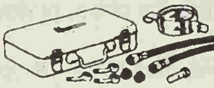
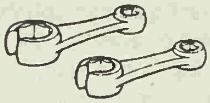
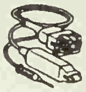
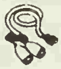
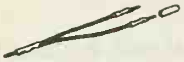
j. Disconnect the Toyota hand-held tester from the DLC3.

2. Check the fuel pressure as follows:

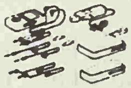
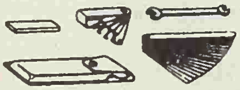
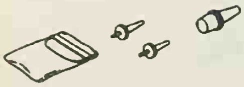
a. Be sure that the battery positive voltage is above 12V.

b. Disconnect the negative cable from the battery.

SST (SPECIAL SERVICE TOOLS)

	09240-00020	Wire Gauge Set	Throttle body
	09268-41045	Injection Measuring Tool Set	
	(09268-52010)	Injection Measuring Attachment	
	09268-45012	EFI Fuel Pressure Gauge	
	09631-22020	Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842-30050	Wire "A" EFI Inspection	
	09842-30070	Wiring "F" EFI Inspection	
	09843-18020	Diagnosis Check Wire	

RECOMMENDED TOOLS

	09082-00050	TOYOTA Electrical Tester Set.	
	09200-00010	Engine Adjust Kit .	
	09258-00030	Hose Plug Set .	Plug for the vacuum hose, fuel hose etc.

86825gb3

Fig. 123 Toyota special service tools for most fuel injected engines

c. Remove the bolts, then disconnect the No. 2 timing belt cover.

d. Wrap a shop towel around the delivery pipe, then slowly loosen the union bolt holding the fuel pipe to the delivery pipe and gasket.

e. Install the SST 09268-45012 (pressure gauge) or its equivalent to the delivery pipe with the two gaskets and the SST (union and union bolt). Tighten to 22 ft. lbs. (29 Nm).

f. Be sure to wipe off any spilled fuel.

g. Attach the Toyota hand-held tester or equivalent scan tool to the DLC3. Reconnect the negative cable to the battery.

h. Start the engine.

i. Measure the fuel pressure, it should read 38-44 psi (265-304 kPa).

j. If the pressure is too high, replace the pressure regulator.

k. If the pressure is too low, check the following:

- Fuel connections and hoses
- Fuel pump
- Fuel filter
- Pressure regulator
- Vacuum Switching Valve (VSV) for fuel pressure control

l. Disconnect the tester from the DLC3.

m. If removed, install the No. 2 timing belt cover, tighten to 80 inch lbs. (9 Nm).

n. Start the engine.

o. Disconnect the vacuum sensing hose from the fuel pressure regulator, then plug the hose end.

p. Measure the pressure at idle, 38-44 psi (265-304 kPa).

q. Reconnect the vacuum, sensing hose to the fuel pressure regulator.

r. Measure the pressure at idle, 31-38 psi (226-265 kPa). If the pressure is not as specified, check the fuel; pump, pressure regulator and/or injectors.

s. Stop the engine.

t. Check that the fuel pressure remains at 21 psi (147 kPa) for 5 minutes after the engine has stopped. If the pressure is not as specified, check the pump, pressure regulator and/or injectors.

u. After checking the fuel pressure, disconnect the negative cable from the battery, then carefully remove the SST 09268-45012 or equivalent, to prevent gas from splashing.

v. Remove the other union bolt, 3 gaskets and fuel pipe from the delivery pipes.

w. Reinstall the fuel pipe with new gaskets and the union bolts, tighten the bolts to 22-25 ft. lbs. (29-34 Nm).

x. Reconnect the negative cable to the battery.

y. Check for leaks.

Throttle Body

REMOVAL & INSTALLATION

5VZ-FE Engine

➧ See Figures 124, 125 and 126

1. Depressurize the fuel system.
2. Drain the cooling system.
3. Disconnect the cables:
   - Accelerator — 1
   - Throttle cable on A/T — 2
   - Cruise control actuator — 3
4. Remove the air cleaner hose.
5. Disconnect the throttle position sensor harness.
6. Separate the idle air control (IAC) connector.
7. Tag and disconnect the following vacuum hoses from the throttle body:
   - Throttle opener
   - EGR vacuum modulator
8. Tag and disconnect the following hoses from the idle air control valve:
   - Water bypass; on EGR vehicles, from the EGR valve
   - Water bypass; without EGR, from the bypass pipe
   - Water hose from the intake manifold
   - Air assist
9. Disconnect the ignition coil wiring.
10. Unbolt the throttle body, remove and discard of the gasket.

To install:

11. Place a new gasket on the air intake chamber facing the protrusion upwards, tighten to 13 ft. lbs. (18 Nm).
12. Attach the ignition coil wiring.
13. Attach the following hoses to the idle air control valve:
    - Water bypass; on EGR vehicles, to the EGR valve
    - Water bypass; without EGR, to the bypass pipe
    - Water hose from the intake manifold
    - Air assist
14. Connect the vacuum hoses to the throttle body:
    - Throttle opener
    - EGR vacuum modulator
15. Secure the Idle Air Control (IAC) and throttle position sensor connectors.
16. Attach the air cleaner hose.
17. Connect the following cables:
    - Accelerator — 1
    - Throttle cable on A/T — 2
    - Cruise control actuator — 3
18. Fill the cooling system with a mixture of water and antifreeze.

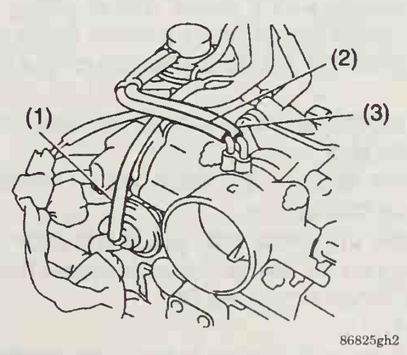


Fig. 124 Remove these vacuum hoses from the throttle body

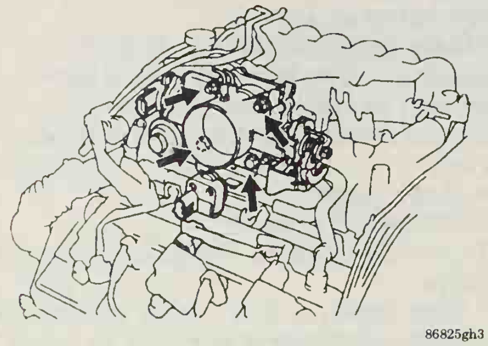


Fig. 125 Remove the 2 nuts and 2 bolts from the throttle body

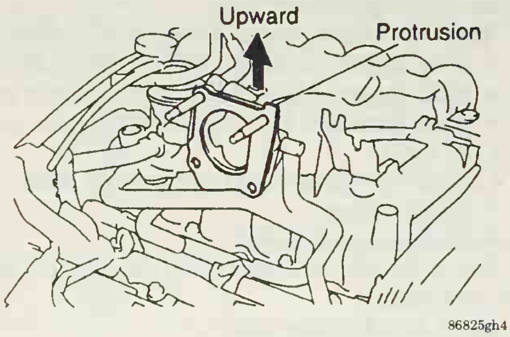


Fig. 126 Ensure that the protrusion is facing upward when installing the gasket

1FZ-FE Engine

1. Depressurize the fuel system.
2. Drain the engine cooling system.
3. Disconnect the PCV and air cleaner hoses.
4. Remove the control cables from the throttle body.
5. Disconnect the throttle position sensor and idle air control wiring.
6. Tag and disconnect all vacuum and water hoses leading to the throttle body.
7. Remove the bolts, and disconnect the throttle body from the air intake chamber.
8. Remove the throttle body gasket and discard.
9. Disconnect the both of the water bypass hoses from the throttle body, then remove the unit.

To install:

10. Attach the water bypass hoses to the throttle body.
11. Install the throttle body with a new gasket, then tighten to 15 ft. lbs. (21 Nm).
12. Install all of the previously tagged vacuum and water hoses.
13. Attach the throttle position sensor and idle air control wiring.
14. Install the control cables to the throttle body.
15. Connect the PCV and air cleaner hoses.
16. Fill the cooling system, start the engine and top off.

INSPECTION

Always clean the throttle body once removed from the vehicle. Wash and clean the cast parts with a soft brush in carburetor cleaner. Using compressed air, clean all of the passages and apertures in the throttle body.

➡To prevent any damage, do not clean the throttle position sensor.

ADJUSTMENTS

Throttle Position Sensor

5VZ-FE ENGINE

➧ See Figures 127, 128 and 129

1. Inspect the sensor with the throttle body off the vehicle, apply vacuum to the throttle opener.
   a. Insert a thickness gauge 0.13 in. (0.32mm) or 0.021 in. (0.54mm) between the throttle stop screw and the stop lever.
   b. Using a ohmmeter, measure the resistance between each terminal.
2. To adjust the sensor, loosen the 2 setscrews of the sensor.
3. Apply vacuum to the throttle opener, then insert a 0.017 in. (0.43mm) gauge between the stop screw and lever.
4. Connect a test probe of the ohmmeter to terminals IDL and E2 of the sensor.
5. Gradually turn the sensor clockwise until the ohmmeter deflects, then secure it with the 2 setscrews.
6. Recheck the continuity of the terminals IDL and E2.

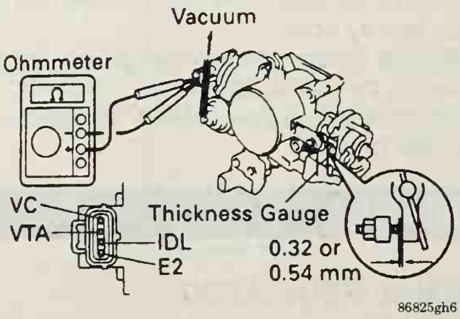


Fig. 127 With the ohmmeter attached to the terminals of the throttle position sensor and vacuum applied, insert a gauge between the stop screw and lever

Clearence between lever end stop screw	Between terminels	Resistence
0 mm (0 in.)	VTA – E2	0.28 – 6.4 kΩ
0.32 mm (0.013 in.)	IDL – E2	0.5 kΩ or less
0.54 mm (0.021 in.)	IDL – E2	Infinity
Throttle velve fully open	VTA – E2	2.0 – 11.6 kΩ
–	VC – E2	2.7 – 7.7 kΩ

86825gh5

Fig. 128 Insert the appropriate thickness gauge and check for proper resistance of the throttle position sensor — 5VZ-FE engine

Clearance between lever and stop screw	Continuity (IDL – E2)
0.32 mm (0.013 in.)	Continuity
0.54 mm (0.021 in.)	No continuity

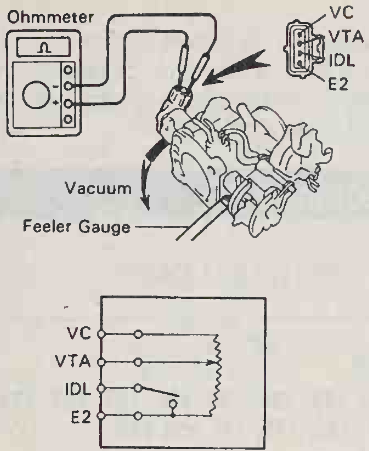
86825gh7

Fig. 129 Insert the appropriate gauge and check for proper resistance to recheck the continuity of the IDL and E2 terminals — 5VZ-FE engine

1FZ-FE ENGINE

➧ See Figures 130, 131 and 132

1. Inspect the sensor with the throttle body off the vehicle, apply vacuum to the throttle opener.
   a. Insert a thickness gauge 0.020 in. (0.50mm) or 0.030 in. (0.75mm) between the throttle stop screw and the stop lever.
   b. Using a ohmmeter, measure the resistance between each terminal. Check the chart for specifications.
2. To adjust the sensor, loosen the 2 setscrews of the sensor.
3. Apply vacuum to the throttle opener, then insert a 0.024 in. (0.62mm) gauge between the stop screw and lever.
4. Connect a test probe of the ohmmeter to terminals IDL and E2 of the sensor.
5. Gradually turn the sensor clockwise until the ohmmeter deflects, then secure it with the 2 setscrews.
6. Recheck the continuity of the terminals IDL and E2.



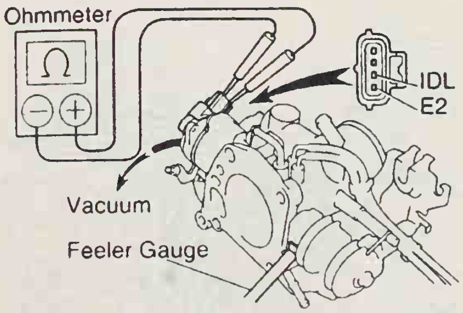
86825gh8

Fig. 130 Using an ohmmeter, measure the resistance between each terminal of the throttle position sensor

Clearence between lever end stop screw	Between terminels	Resistence
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.75 mm (0.030 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

86825gh9

Fig. 131 Insert the appropriate thickness gauge and check for proper resistance of the throttle position sensor — 1FZ-FE engine



86825gi0

Fig. 132 Recheck the continuity of the terminals IDL and E2 — 1FZ-FE engine

Throttle Valve

1. Apply vacuum to the throttle opener.
2. Check that there is no clearance between the throttle stop screw and the throttle lever when the valve is fully closed. The fully closed angle should be 10°.

Fuel Injectors

REMOVAL & INSTALLATION

1FZ-FE Engine

➧ See Figures 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147 and 148

1. Depressurize the fuel system.
2. Drain the engine cooling system.
3. Disconnect the cruise control accelerator cable and throttle cable.
4. Detach the No. 2 PCV hose.
5. Remove the air cleaner hose.
6. Remove the EGR vacuum modulator and valve.
7. Unbolt the heater inlet pipe and air intake chamber.
8. Disconnect the PCV hose.
9. Remove the vacuum sensing hose.
10. Remove the water bypass and the EVAP hoses.
11. Disconnect the brake booster hose.
12. Disconnect the throttle position sensor, idle air control valve, emission control valve set assembly and EGR gas temperature sensor wiring.
13. Remove the bolts retaining the power steering reservoir tank.
14. Remove the engine oil dipstick.
15. Unbolt the ground strap.
16. Remove the intake manifold stay.
17. Disconnect the vacuum hoses to the Thermal Vacuum Valve (TVV).
18. Remove the water bypass hose from the cylinder head.
19. Remove the air intake chamber and discard of the gaskets.

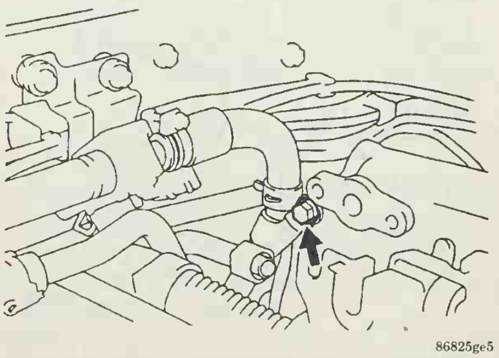


Fig. 133 Remove the bolt holding the heater inlet pipe and air intake chamber

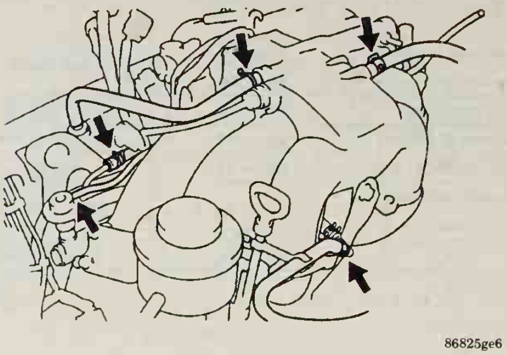


Fig. 134 Disconnect all of the hoses marked by the arrows

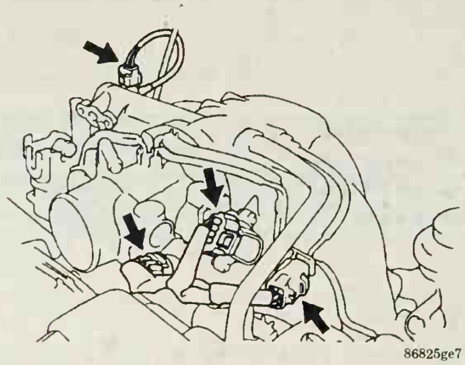


Fig. 135 Unclamp these arrowed terminals

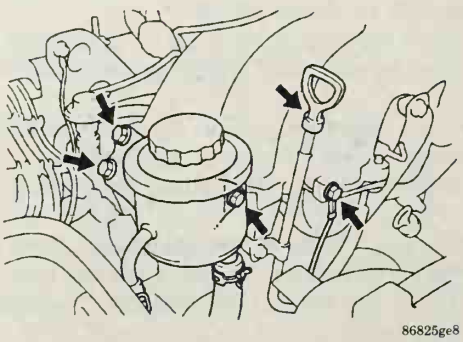


Fig. 136 Remove all components marked by the arrows

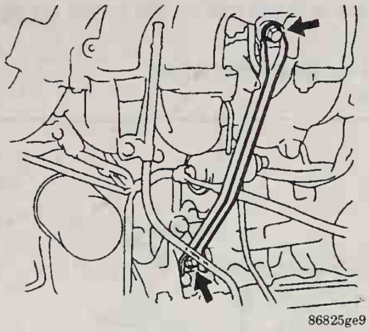


Fig. 137 The intake manifold stay is simply a brace secured by two bolts

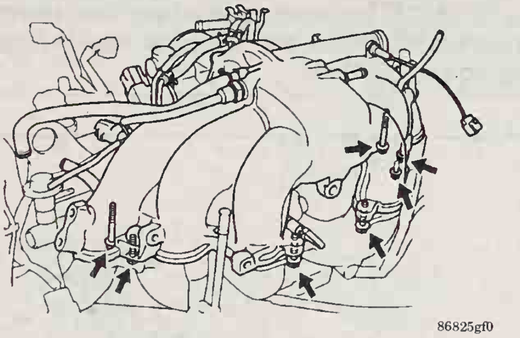


Fig. 138 The intake manifold is usually retained by 6 bolts and 2 nuts

20. Remove the 2 union bolts, gaskets and fuel inlet pipe.
21. Remove the delivery pipe and injectors as follows:
    a. Unsecure the 6 injector connectors.
    b. Remove the bolts and delivery pipe together with the 6 injectors. Be careful not to drop the injectors when removing the pipe.
    c. Remove the insulators and spacers on the intake manifold.
    d. Pull the injectors out of the delivery pipe. Remove the O-rings and grommets from each injector.
22. Inspect the injectors.

To install:

23. Install new grommets on each injector, then apply a light coat of gasoline to the new O-rings and install them.
24. While turning the injector left and right, install it to the delivery pipe. Install all 6 injectors.
25. Position the injector connector upwards. Place new insulators and spacers in position on the intake manifold.
26. Temporarily install the bolts holding the delivery pipe to the intake manifold.

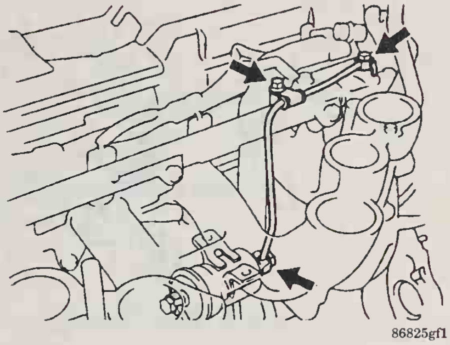


Fig. 139 Remove the fuel inlet pipe; it runs down to the fuel filter

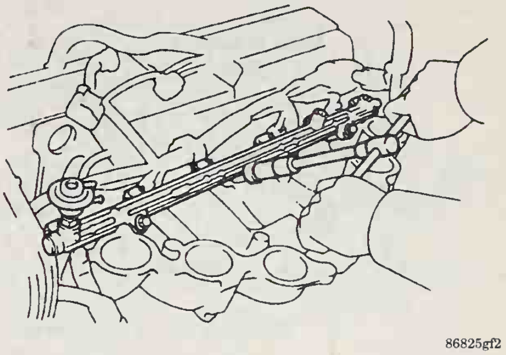


Fig. 140 The injectors are removed with the fuel delivery pipe

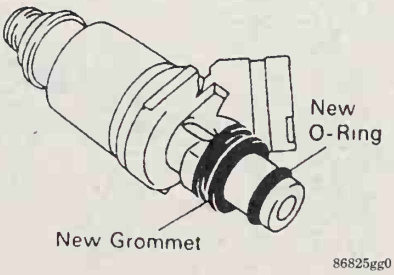


Fig. 141 Install a new grommet and lubricated O-ring on the injector

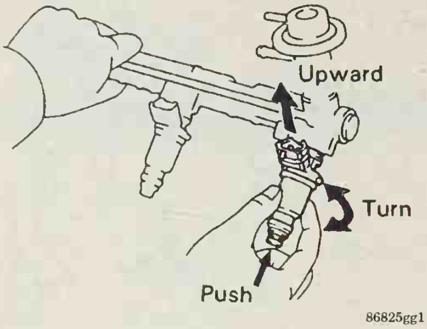

Upward
Turn
Push
86825gg1

Fig. 142 Install each injector to the delivery pipe by pushing while twisting the injector

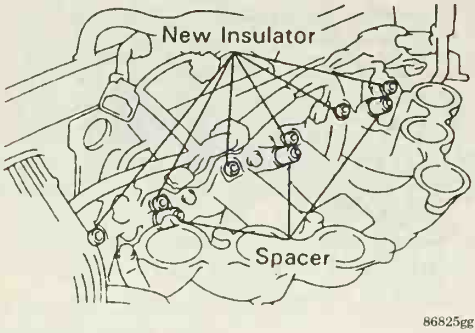

New Insulator
Spacer
86825gg2

Fig. 143 Place new insulators and spacers in the indicated positions

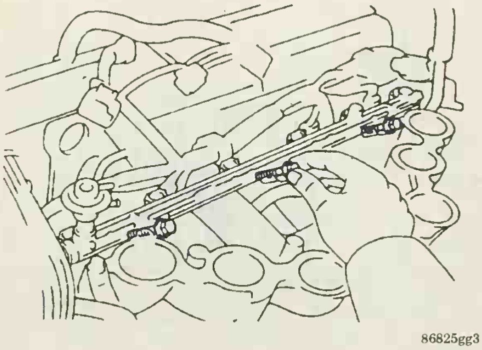


Fig. 144 Temporarily install the bolts holding the delivery pipe to the intake manifold

27. Check the the injectors rotate smoothly. If they do not, recheck the position of the O-rings, or replace them.
28. Position the injector connector upward, then tighten the bolts holding the delivery pipe to the intake manifold to 15 ft. lbs. (21 Nm).
29. Attach the injector connectors.

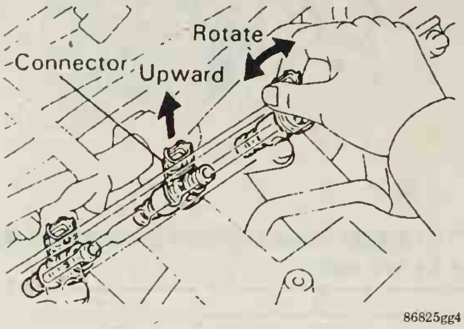

Rotate
Connector
Upward
86825gg4

Fig. 145 Rotate the injectors to ensure their smooth movement. An injector that binds has been improperly installed and may leak

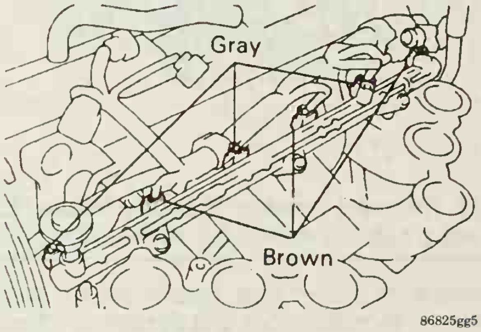

Gray
Brown
86825gg5

Fig. 146 Attach the colored connectors to their correct locations

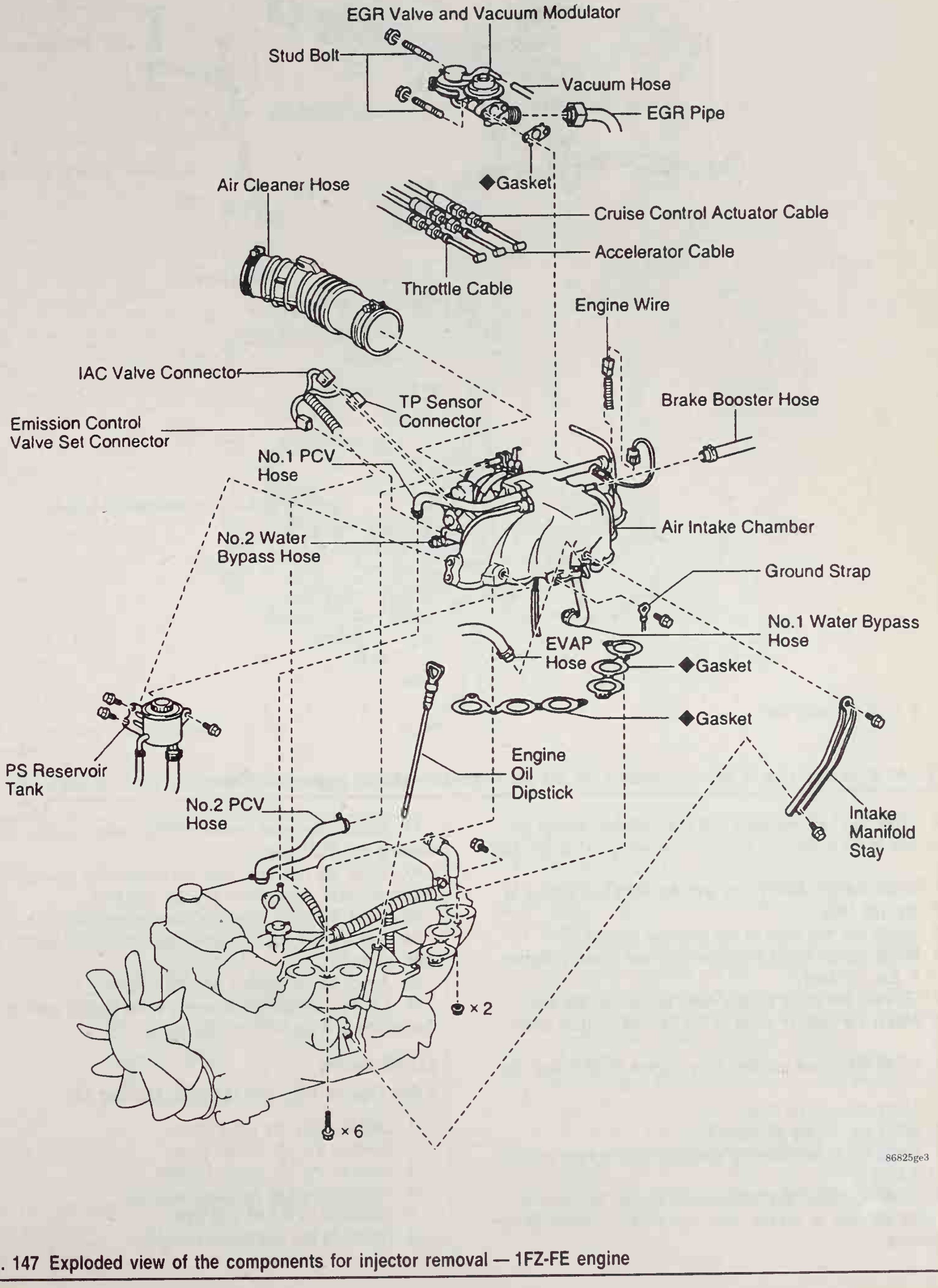

EGR Valve and Vacuum Modulator
Stud Bolt
Vacuum Hose
EGR Pipe
◆Gasket
Air Cleaner Hose
Cruise Control Actuator Cable
Accelerator Cable
Throttle Cable
Engine Wire
IAC Valve Connector
TP Sensor Connector
Brake Booster Hose
Emission Control Valve Set Connector
No.1 PCV Hose
No.2 Water Bypass Hose
Air Intake Chamber
Ground Strap
No.1 Water Bypass Hose
EVAP Hose
◆Gasket
◆Gasket
PS Reservoir Tank
Engine Oil Dipstick
No.2 PCV Hose
Intake Manifold Stay
× 2
× 6
86825ge3

Fig. 147 Exploded view of the components for injector removal — 1FZ-FE engine

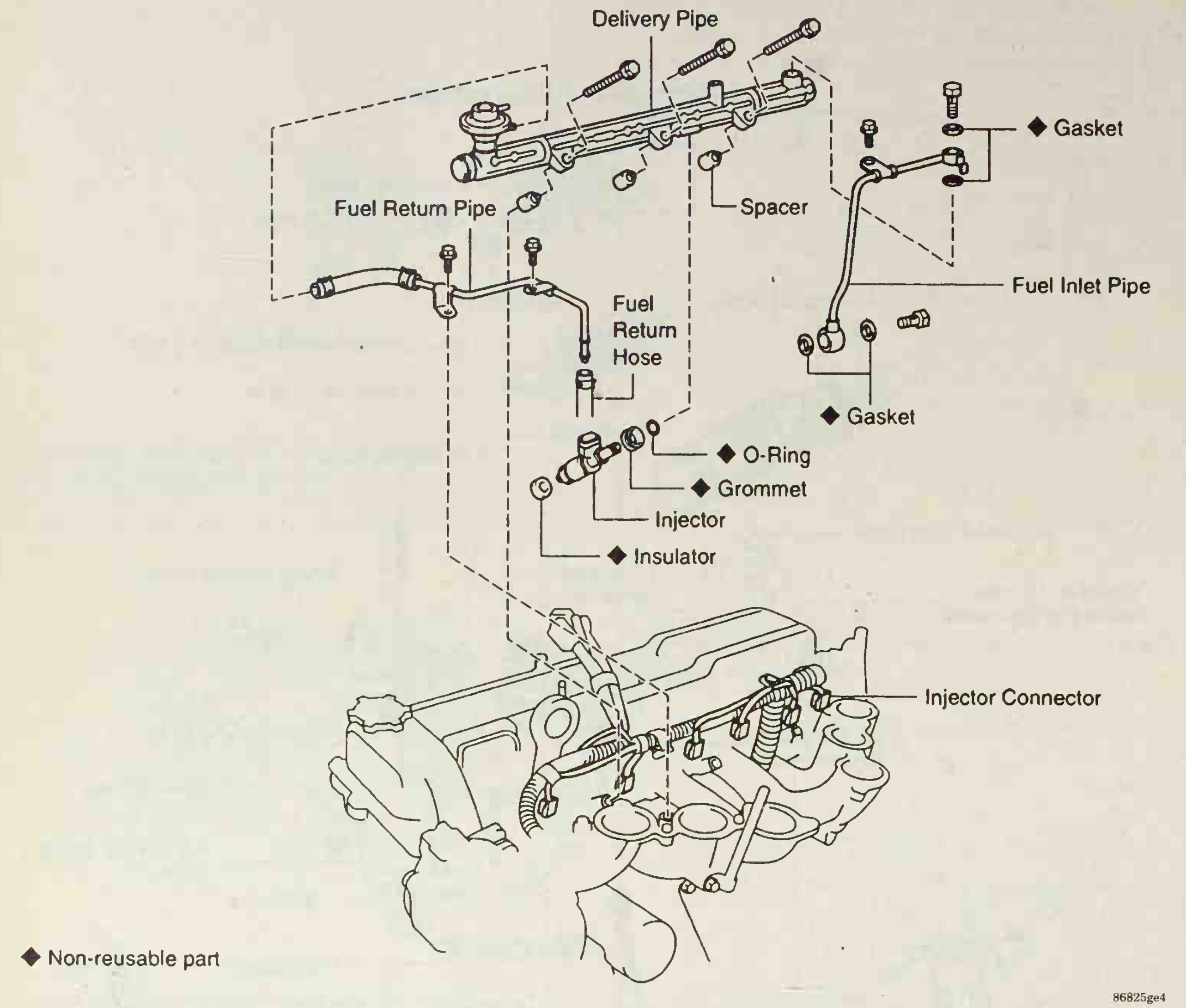


Fig. 148 Exploded view of the components for injector removal — 1FZ-FE engine (continued)

30. Install the fuel inlet pipe with new gaskets, tighten the union bolt to 22 ft. lbs. (29 Nm) and the bolt to 14 ft. lbs. (20 Nm).
31. Install the fuel return pipe with the bolts and tighten to 14 ft. lbs. (20 Nm).
32. Attach the fuel hose to the pressure regulator.
33. Install the air intake chamber with new gaskets, tighten to 15 ft. lbs. (21 Nm).
34. Connect the water bypass hose to the cylinder head.
35. Attach the vacuum hose to the thermal vacuum valve (TVV).
36. Install the intake manifold stay, tighten to 26 ft. lbs. (36 Nm).
37. Attach the ground strap.
38. Install the engine oil dipstick.
39. Install the power steering reservoir tank, tighten to 13 ft. lbs. (18 Nm).
40. Attach the EGR gas temperature sensor, emission control valve set, idle air control valve and throttle position sensor connectors.
41. Secure the brake booster, EVAP, water bypass, vacuum sensing and PCV hoses.
42. Install the bolt that holds the heater inlet pipe and air intake chamber, tighten to 14 ft. lbs. (20 Nm).
43. Install the EGR valve and vacuum modulators.
44. Connect the throttle, accelerator and cruise control actuator cables.
45. Attach the air cleaner and PCV hoses.
46. Fill the cooling system with a water/coolant mixture. Start the engine and top off. Look for leaks.

5VZ-FE Engine

➧ See Figures 149, 150, 151, 152, 153 and 154

1. Depressurize the fuel system.
2. Remove the air cleaner hose.
3. Remove the air intake chamber.
4. Remove the fuel pressure regulator.
5. Disconnect the fuel inlet pipe.
6. Unsecure the injector connections.

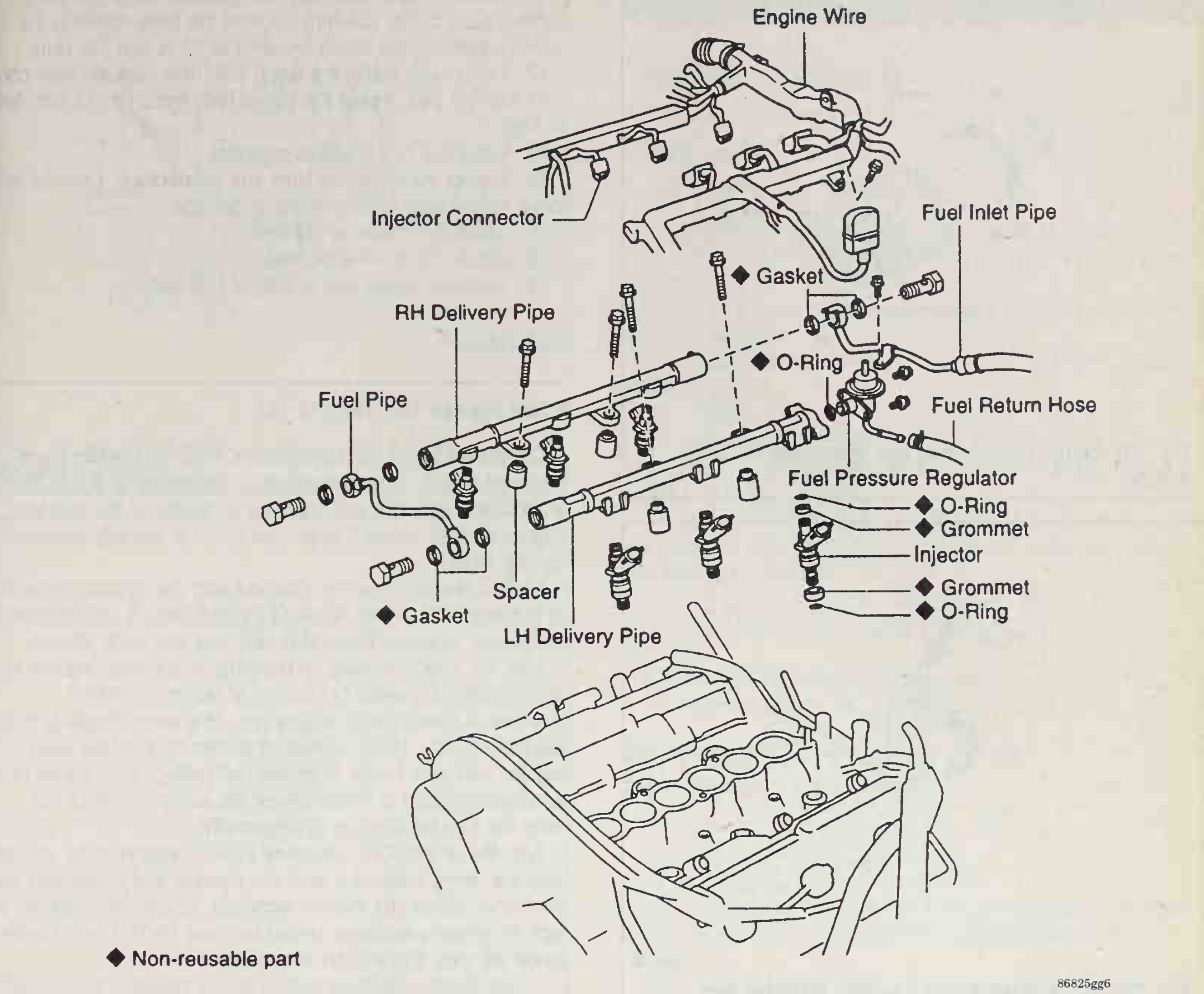

Engine Wire
Injector Connector
Fuel Inlet Pipe
◆ Gasket
RH Delivery Pipe
◆ O-Ring
Fuel Pipe
Fuel Return Hose
Fuel Pressure Regulator
◆ O-Ring
◆ Grommet
Injector
◆ Grommet
◆ O-Ring
Spacer
◆ Gasket
LH Delivery Pipe
◆ Non-reusable part
86825gg6

Fig. 149 Exploded view of the 5VZ-FE injector components

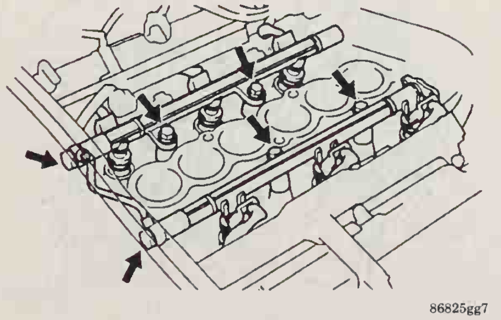


Fig. 150 Remove the six mounting bolts from the delivery pipes

7. Unbolt and remove the delivery pipes together with the injectors.
8. Remove the spacers from the intake manifold.
9. Pull the injectors out of the delivery pipes, then remove the O-rings and grommets from each injector.

To install:

10. Install new grommets and O-rings on each injector. Apply a light coat of gasoline on the O-rings.
    a. While turning the injector clockwise and counterclockwise, push it into the delivery pipe. Install all of the injectors.
    b. Position the injector connector outward.
    c. Place the spacers into position on the intake manifold. Temporarily install the bolts to hold the delivery pipes to the intake manifold.
    d. Check that the injectors rotate smoothly. If they do not, the O-rings have probably been installed incorrectly. If this has occurred, replace the O-rings with new ones.
    e. Position the injector outward, then attach the injector connectors.

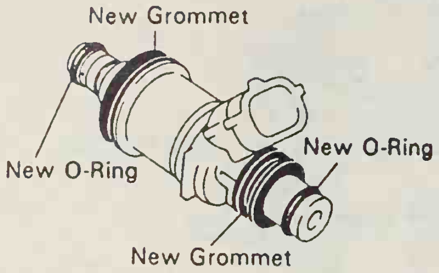


Fig. 151 Install new O-rings and grommets on each injector

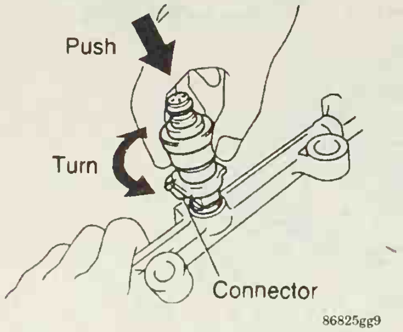


Fig. 152 While twisting the injector clockwise and counterclockwise, push it into its delivery pipe

11. Install the fuel pipe with new gaskets and union bolts, tighten to 25 ft. lbs. (34 Nm). Tighten the bolts retaining the delivery pipes to the intake manifold to 10 ft. lbs. (13 Nm).
12. Temporarily install the union with new gaskets, then connect the fuel pipe. Install the clamp bolt, tighten to 71 inch lbs. (8 Nm).
13. Install the fuel pressure regulator.
14. Inspect the air assist lines and connections. Look for any loose connections, sharp bends or damage.
15. Install the intake air cleaner.
16. Attach the air cleaner hose.
17. Start the engine and check for fuel leaks.

TESTING

See Figures 155, 156 and 157

Correct testing of the fuel injectors requires specific equipment not usually available outside a dealership or a fuel lab. It is recommended that any checking or testing of the injectors, other than that included below, be left to a properly equipped service facility.

Injector operation can be checked with the injectors installed in the engine. A sound scope is needed here, a stethoscope-like device available from most auto tool and parts jobbers.

With the engine running or cranking, check each injector for normal operating noise (a buzzing or humming), which changes in proportion to engine rpm. If a sound scope is not available to you, check injector operation by touching each injector with your finger. It should be buzzing. If no sound or an unusual sound is heard, check the wiring connector, or have the injector checked professionally.

With the engine **OFF**, measure injector resistance by unplugging the wiring connector from the injector, and connecting an ohmmeter across the injector terminals. Check the continuity at both terminals; resistance should be: cold 12-16 ohms. Resistance will vary with injector temperature.

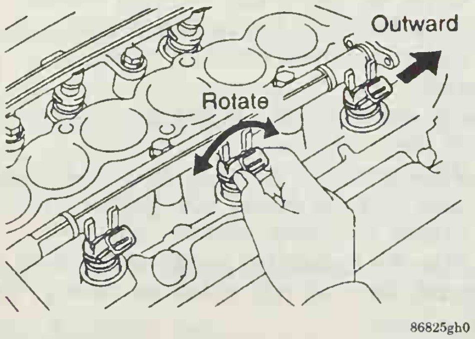


Fig. 153 Check that the injectors rotate smoothly. If they do not, the O-rings have probably been installed incorrectly

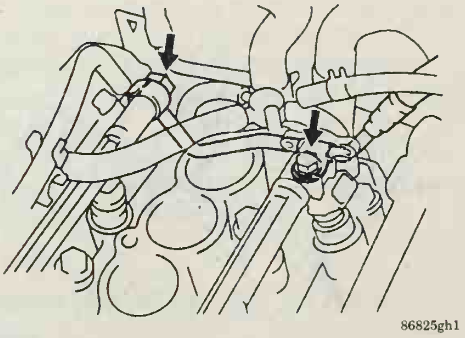


Fig. 154 Temporarily install the union with new gaskets, then connect the fuel pipe. Install the clamp bolt and tighten to 71 inch lbs. (8 Nm)

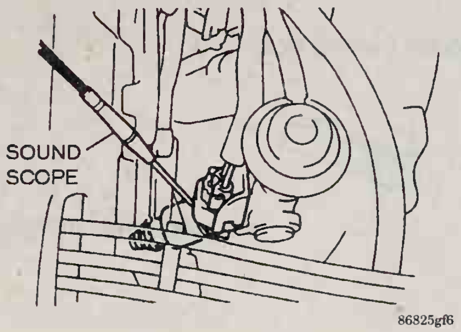


Fig. 155 A sound scope is usually used to inspect injector operation

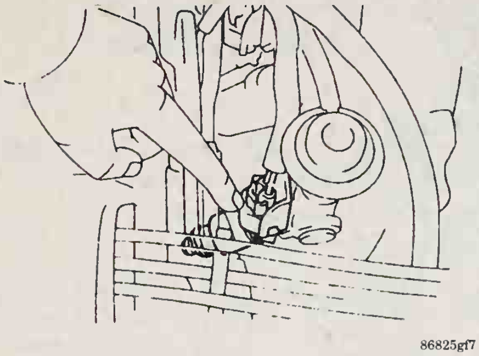


Fig. 156 If a sound scope is not available, check the operation with your finger

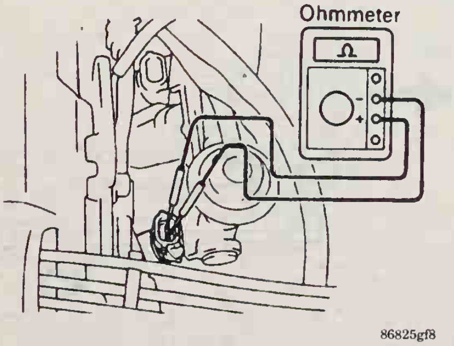


Fig. 157 An ohmmeter is used to check injector resistance

Fuel Pressure Regulator

REMOVAL & INSTALLATION

1FZ-FE Engine

➧ See Figures 158, 159 and 160

1. Depressurize the fuel system.
2. Disconnect the vacuum sensing hose from the pressure regulator.
3. Wrap a towel around the regulator then disconnect the fuel return hose.
4. Loosen the locknut, then remove the regulator. Discard of the O-ring.

To install:

5. Fully loosen the locknut on the regulator.
6. Apply a light coat of gasoline to a new O-ring, then install it onto the regulator.
7. Insert the regulator into the delivery pipe by hand. Turn the regulator counterclockwise until the fuel outlet port faces in the direction indicated.
8. Tighten the locknut to 18 ft. lbs. (25 Nm).
9. Using new gaskets, install the return pipe to the regulator.
10. Connect the vacuum sensing hose.
11. Start the engine and check for any fuel leakage.

5VZ-FE Engine

➧ See Figures 161 and 162

1. Depressurize the fuel system.
2. Remove the air cleaner hose.
3. Remove the intake air connector.
4. Disconnect the fuel return hose from the pressure regulator. Place a shop rag under the regulator to catch any leakage.
5. Remove the bolt holding the engine wire to the left-hand valve cover.
6. Disconnect the protector from the bracket on the right side valve cover, then lift up the engine wire.
7. Remove the 2 bolts, then pull out the regulator. Remove and discard the O-ring from the unit.

To install:

8. Apply a light coat of gasoline to the new O-ring, then install it on the regulator.
9. Attach the regulator to the left side delivery pipe.
10. Check that the pressure regulator rotates smoothly. If it does not, the O-ring may be the cause. Remove the regulator and install a new O-ring.
11. Attach the regulator, then tighten to 71 inch lbs. (8 Nm).
12. Install the engine wire with the bolt.
13. Attach the fuel return hose to the pressure regulator. Be sure not to insert the hose up to the stopper and clip it.
14. Install the intake air connector.
15. Install the air cleaner hose.
16. Start the engine and check for leaks.

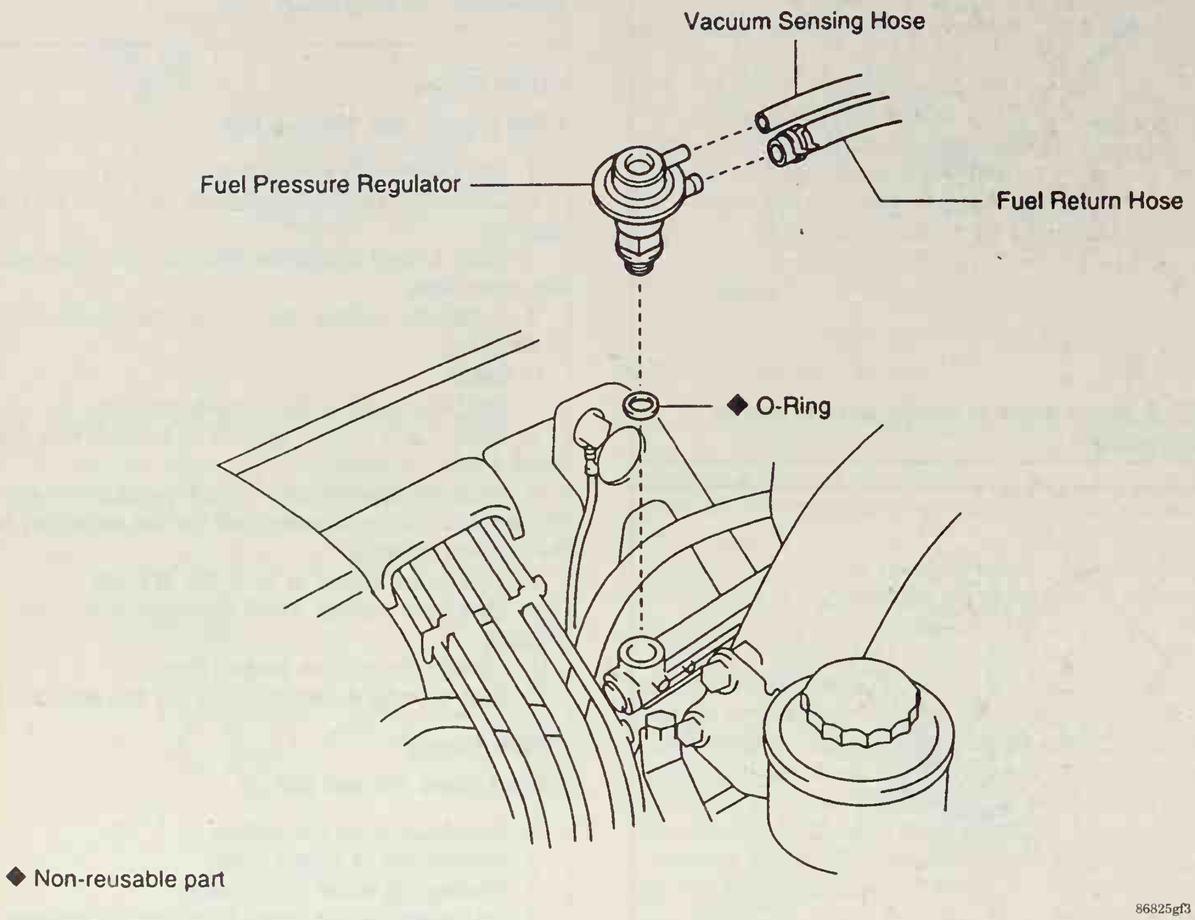

Vacuum Sensing Hose
Fuel Pressure Regulator
Fuel Return Hose
◆ O-Ring
◆ Non-reusable part
86825gf3

Fig. 158 The regulator is in plain view, on top of the fuel rail — 1FZ-FE engine

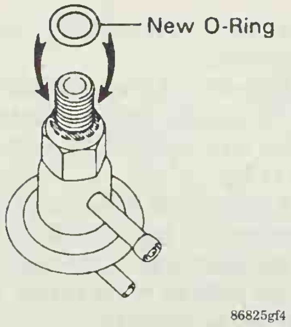

New O-Ring
86825gf4

Fig. 159 Install the new O-ring with a light coat of gasoline on it

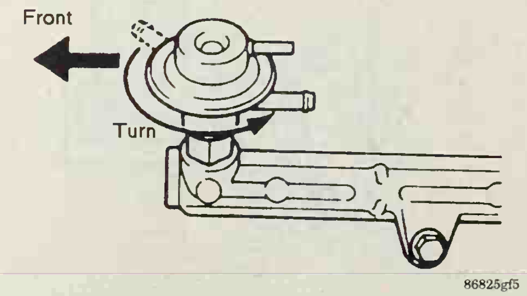

Front
Turn
86825gf5

Fig. 160 The regulator must be properly aligned on the delivery pipe

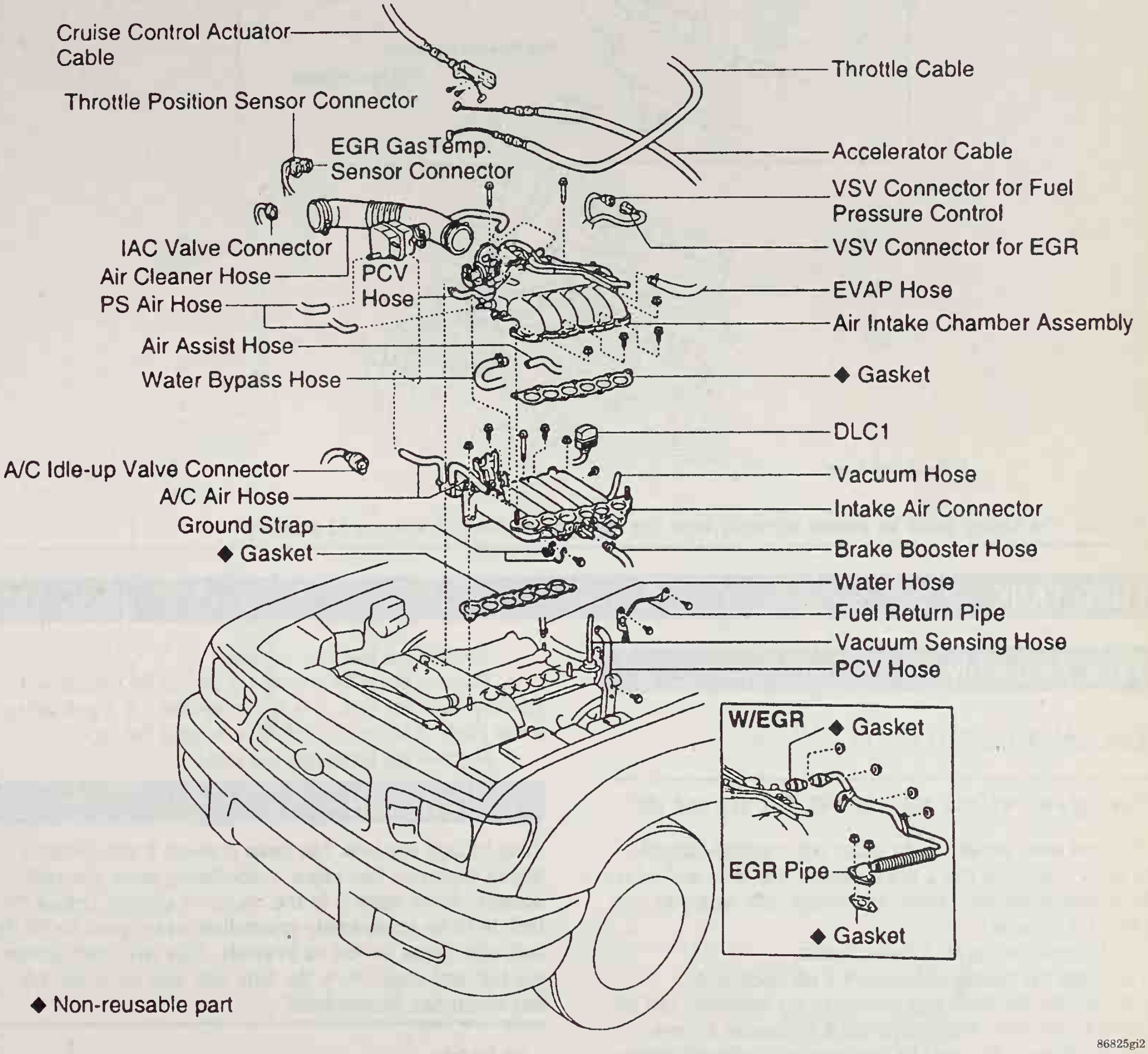

Cruise Control Actuator Cable
Throttle Position Sensor Connector
EGR GasTemp. Sensor Connector
IAC Valve Connector
Air Cleaner Hose
PCV Hose
PS Air Hose
Air Assist Hose
Water Bypass Hose
A/C Idle-up Valve Connector
A/C Air Hose
Ground Strap
◆ Gasket
Throttle Cable
Accelerator Cable
VSV Connector for Fuel Pressure Control
VSV Connector for EGR
EVAP Hose
Air Intake Chamber Assembly
◆ Gasket
DLC1
Vacuum Hose
Intake Air Connector
Brake Booster Hose
Water Hose
Fuel Return Pipe
Vacuum Sensing Hose
PCV Hose
W/EGR
◆ Gasket
EGR Pipe
◆ Gasket
◆ Non-reusable part
86825gi2

Fig. 161 Exploded view of the components which must be removed to access the fuel pressure regulator

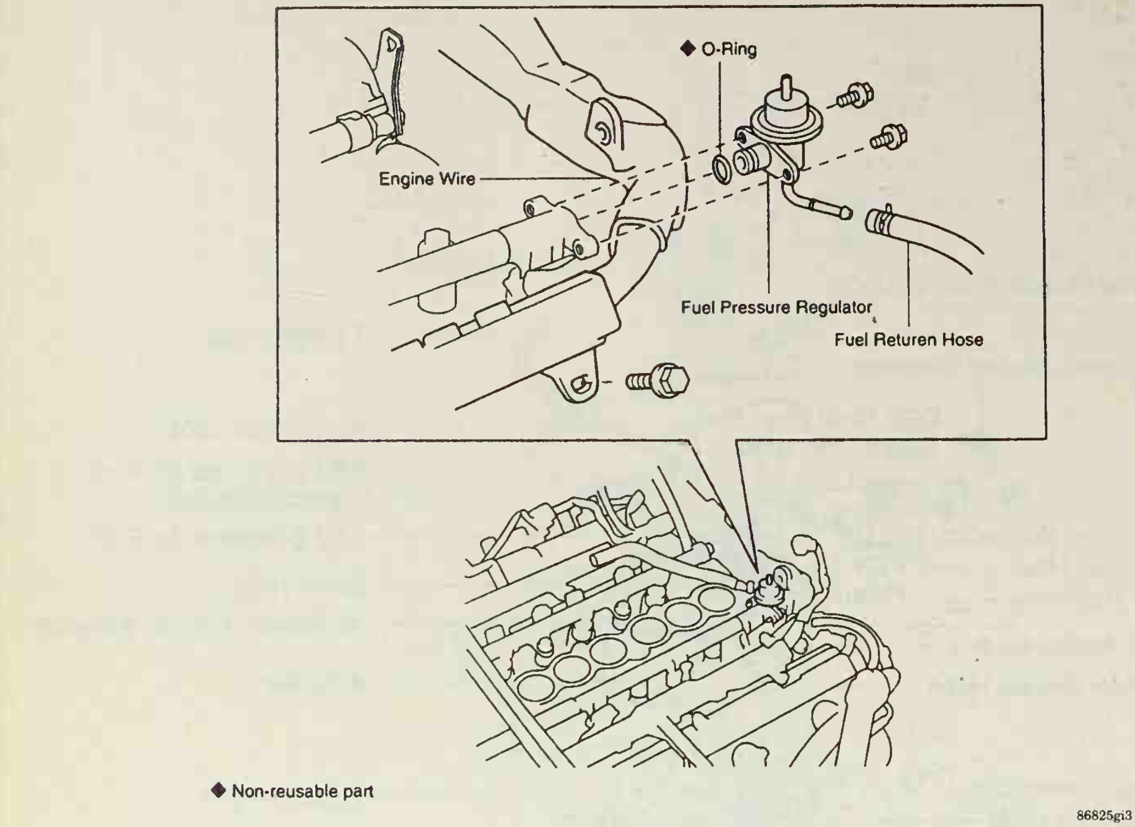


Fig. 162 The O-ring must be placed correctly onto the regulator or the unit will not fit properly

FUEL TANK

Tank Assembly

REMOVAL & INSTALLATION

➧ See Figures 163, 164, 165, 166, 167, 168, 169 and 170

The gas tanks on all Toyota trucks are mounted basically the same. Each one has a shield, straps, inlet pipe and so on. The procedure below is basic, and should help ease your way to the tank removal.

1. Remove the negative battery cable.
2. Raise the vehicle and support it with jackstands.
3. Remove the drain plug and drain any remaining fuel into a suitable container. Remember that it is possible to have several gallons in the tank; be prepared with sufficient containers. It is best to run the tank as low on fuel as possible before removing it, but Empty on the gauge may still leave 2 or 3 gallons in the tank.
4. Disconnect the plug from the pump and sending unit. Remove the gravel shield from the tank.
5. Disconnect the fuel lines. Plug all the lines to prevent fuel from leaking.
6. Disconnect the filler neck and vent line.
7. Remove the fuel tank protector.
8. Remove the bolts holding the tank to the vehicle and carefully lower the tank. It is recommended that a jack with a broad piece of lumber be placed to support the tank.
9. Remove the fuel pump assembly.

✱✱CAUTION

Even though the tank has been drained, it still contains highly explosive fuel vapor. Immediately place the tank outside; never store it in the house or garage. Unless the tank is to be immediately reinstalled, use a hose to fill the tank with water as full as possible. This will flush remaining fuel and vapor from the tank and also carry off any dirt which has accumulated.

To install:

10. Make certain the fuel tank is completely dry if it has been flushed. Install the pump assembly.
11. Install the fuel tank. Tighten the tank bolts.
12. Connect the lines and hoses. Make certain the hoses are not crimped or pinched. Make sure the clamps are correctly seated.
13. Connect the negative battery cable.

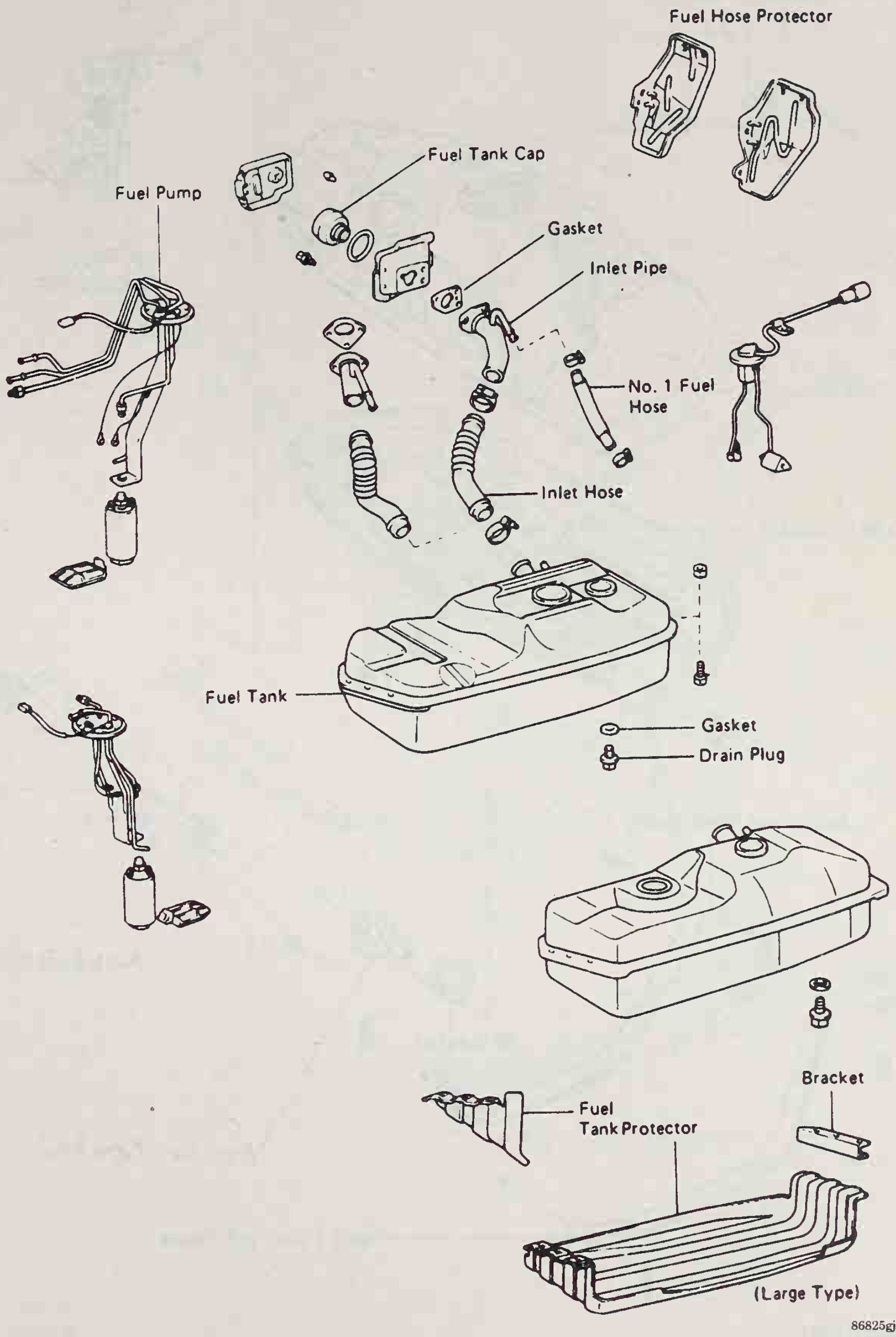

Fuel Hose Protector
Fuel Tank Cap
Fuel Pump
Gasket
Inlet Pipe
No. 1 Fuel Hose
Inlet Hose
Fuel Tank
Gasket
Drain Plug
Bracket
Fuel Tank Protector
(Large Type)
86825gj0

Fig. 163 Exploded view of the fuel tank components — 1989-95 Pick-Ups

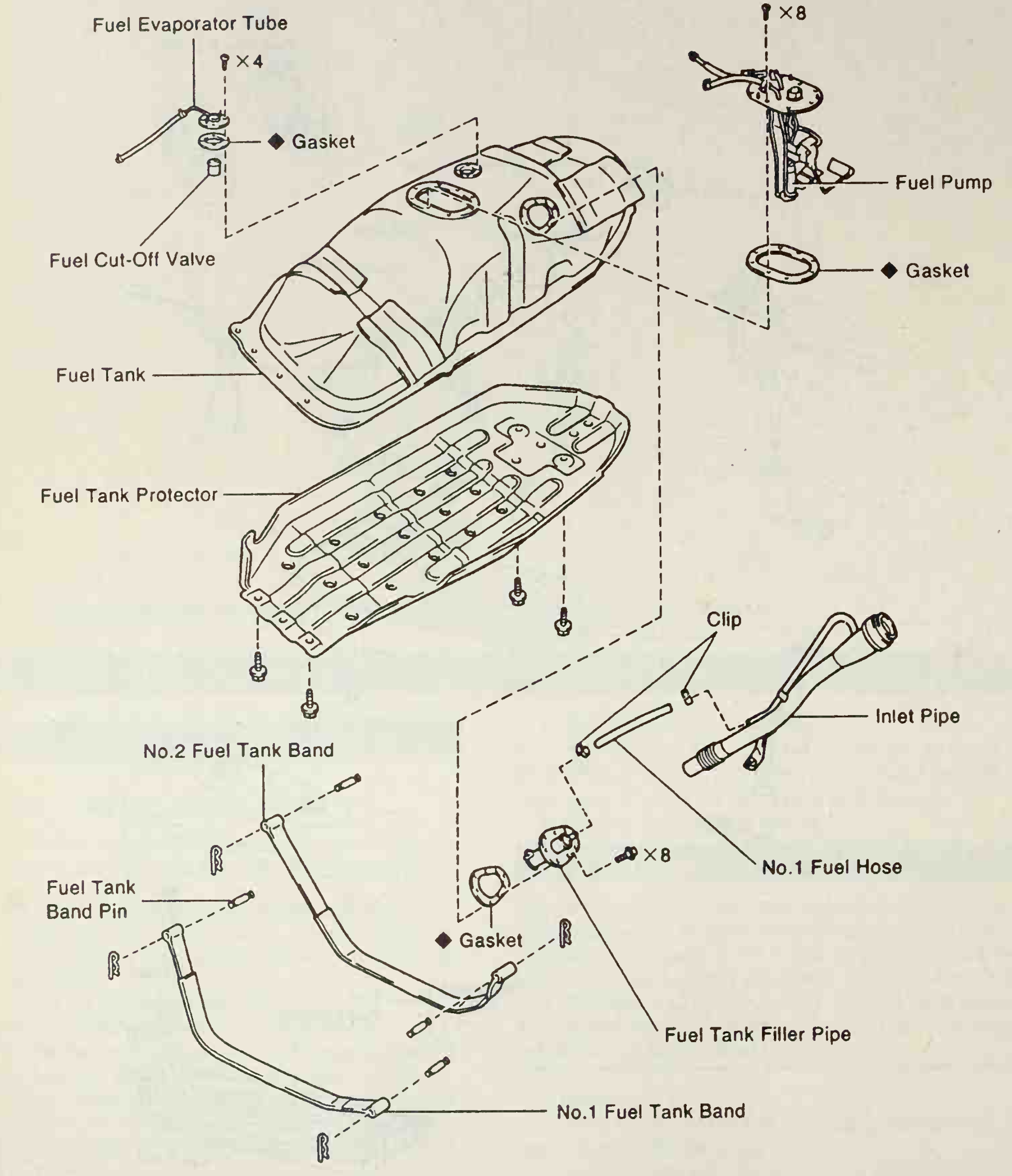

Fuel Evaporator Tube
×4
◆ Gasket
Fuel Cut-Off Valve
×8
Fuel Pump
◆ Gasket
Fuel Tank
Fuel Tank Protector
Clip
Inlet Pipe
No.2 Fuel Tank Band
×8
No.1 Fuel Hose
Fuel Tank
Band Pin
◆ Gasket
Fuel Tank Filler Pipe
No.1 Fuel Tank Band
◆ Non-reusable part
86825gj1

Fig. 164 Exploded view of the fuel tank components — Tacoma

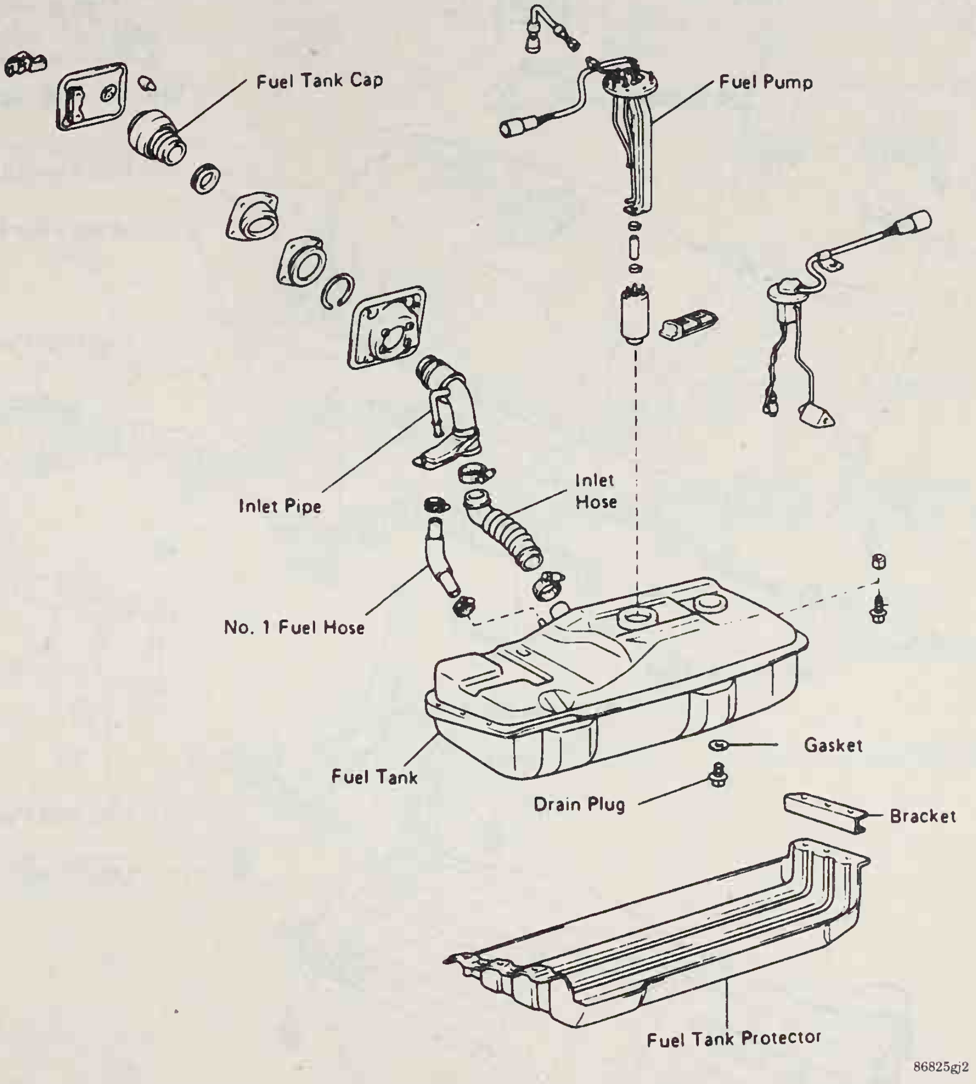

Fuel Tank Cap
Fuel Pump
Inlet Pipe
Inlet Hose
No. 1 Fuel Hose
Fuel Tank
Gasket
Drain Plug
Bracket
Fuel Tank Protector
86825gj2

Fig. 165 Exploded view of the fuel tank components — 1989-95 4Runner

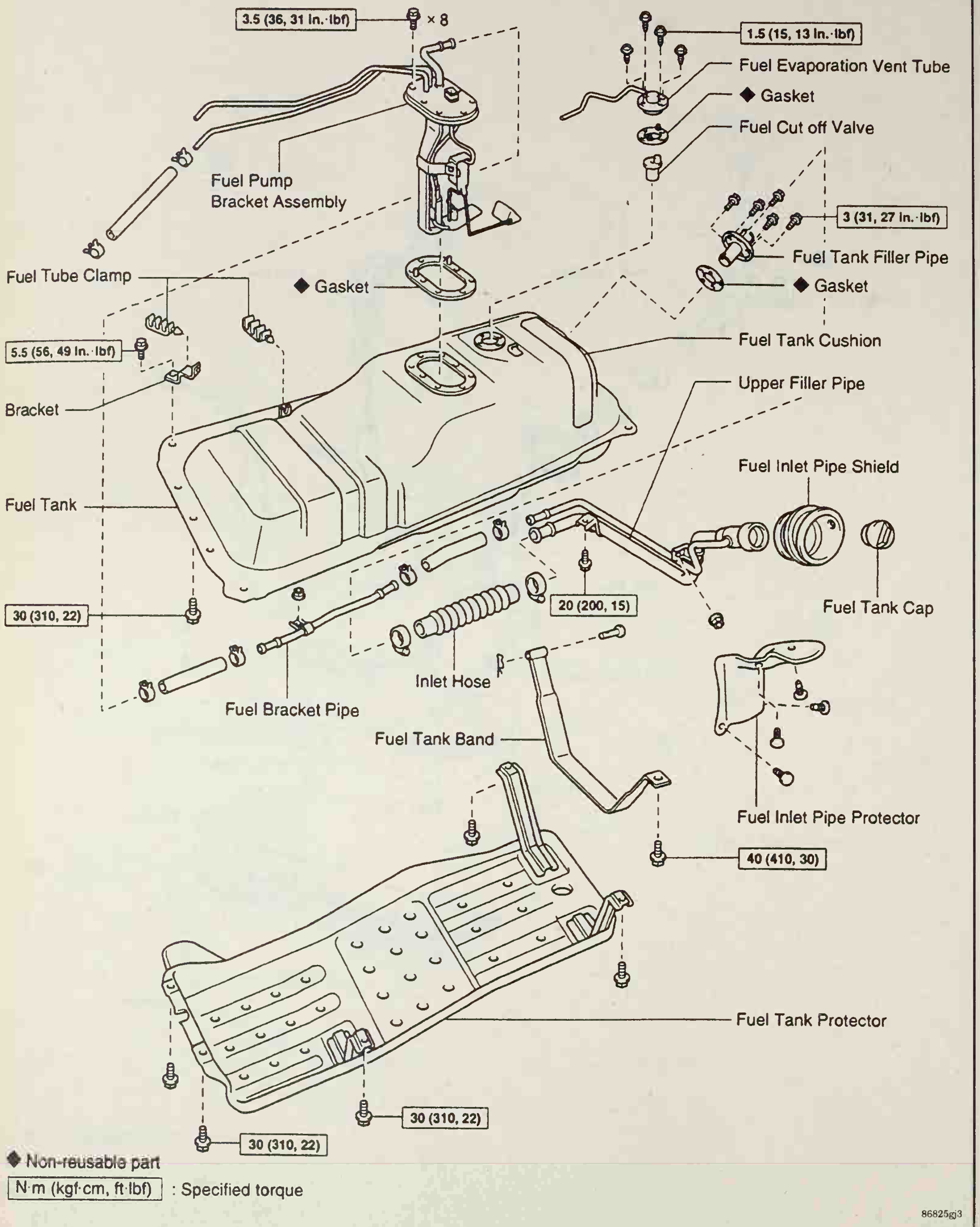

3.5 (36, 31 in.·lbf)
× 8
1.5 (15, 13 in.·lbf)
Fuel Evaporation Vent Tube
◆ Gasket
Fuel Cut off Valve
Fuel Pump
Bracket Assembly
3 (31, 27 in.·lbf)
Fuel Tank Filler Pipe
Fuel Tube Clamp
◆ Gasket
◆ Gasket
5.5 (56, 49 in.·lbf)
Fuel Tank Cushion
Upper Filler Pipe
Bracket
Fuel Inlet Pipe Shield
Fuel Tank
Fuel Tank Cap
30 (310, 22)
20 (200, 15)
Inlet Hose
Fuel Bracket Pipe
Fuel Tank Band
Fuel Inlet Pipe Protector
40 (410, 30)
Fuel Tank Protector
30 (310, 22)
30 (310, 22)
◆ Non-reusable part
N·m (kgf·cm, ft·lbf) : Specified torque
86825gj3

Fig. 166 Exploded view of the fuel tank components — 1996 4Runner

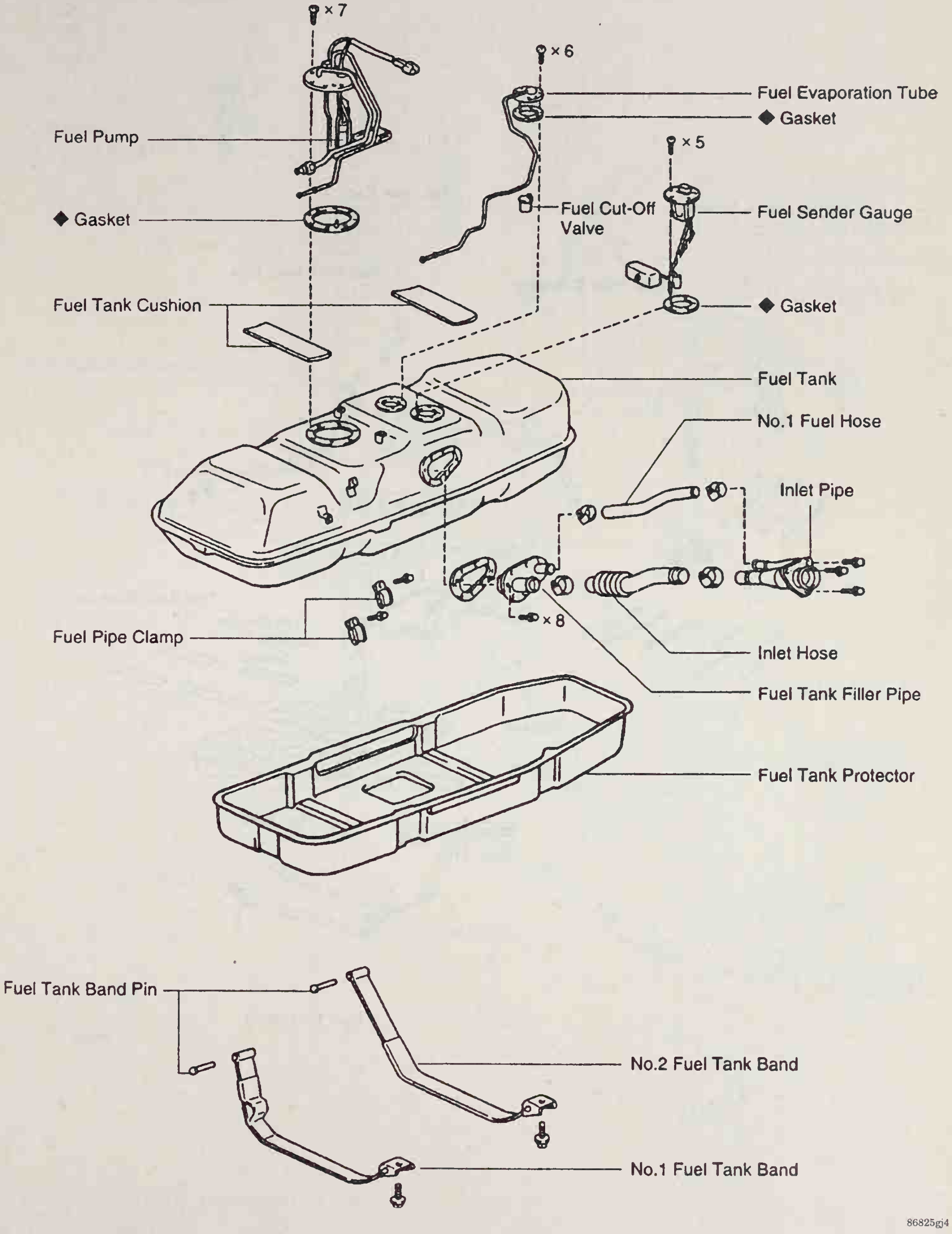

× 7
× 6
× 5
× 8
Fuel Evaporation Tube
◆ Gasket
Fuel Pump
Fuel Cut-Off Valve
Fuel Sender Gauge
◆ Gasket
Fuel Tank Cushion
◆ Gasket
Fuel Tank
No.1 Fuel Hose
Inlet Pipe
Fuel Pipe Clamp
Inlet Hose
Fuel Tank Filler Pipe
Fuel Tank Protector
Fuel Tank Band Pin
No.2 Fuel Tank Band
No.1 Fuel Tank Band
86825gj4

Fig. 167 Exploded view of the fuel tank components — T100

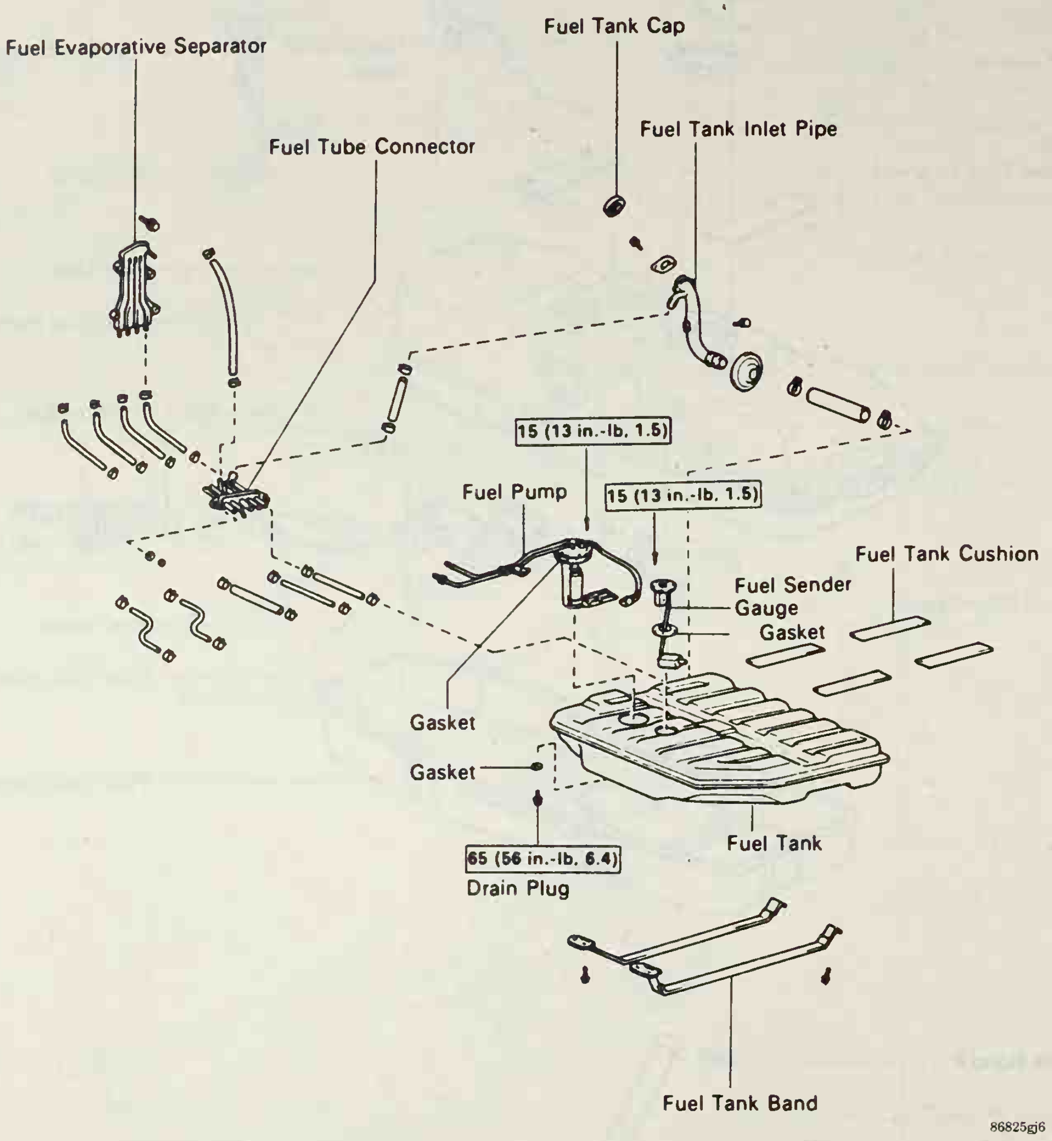

Fuel Evaporative Separator
Fuel Tank Cap
Fuel Tank Inlet Pipe
Fuel Tube Connector
15 (13 in.-lb, 1.5)
Fuel Pump
15 (13 in.-lb, 1.5)
Fuel Tank Cushion
Fuel Sender Gauge
Gasket
Gasket
Gasket
Fuel Tank
65 (56 in.-lb, 6.4)
Drain Plug
Fuel Tank Band
86825gj6

Fig. 168 Exploded view of the fuel tank components — 1989-91 Land Cruiser

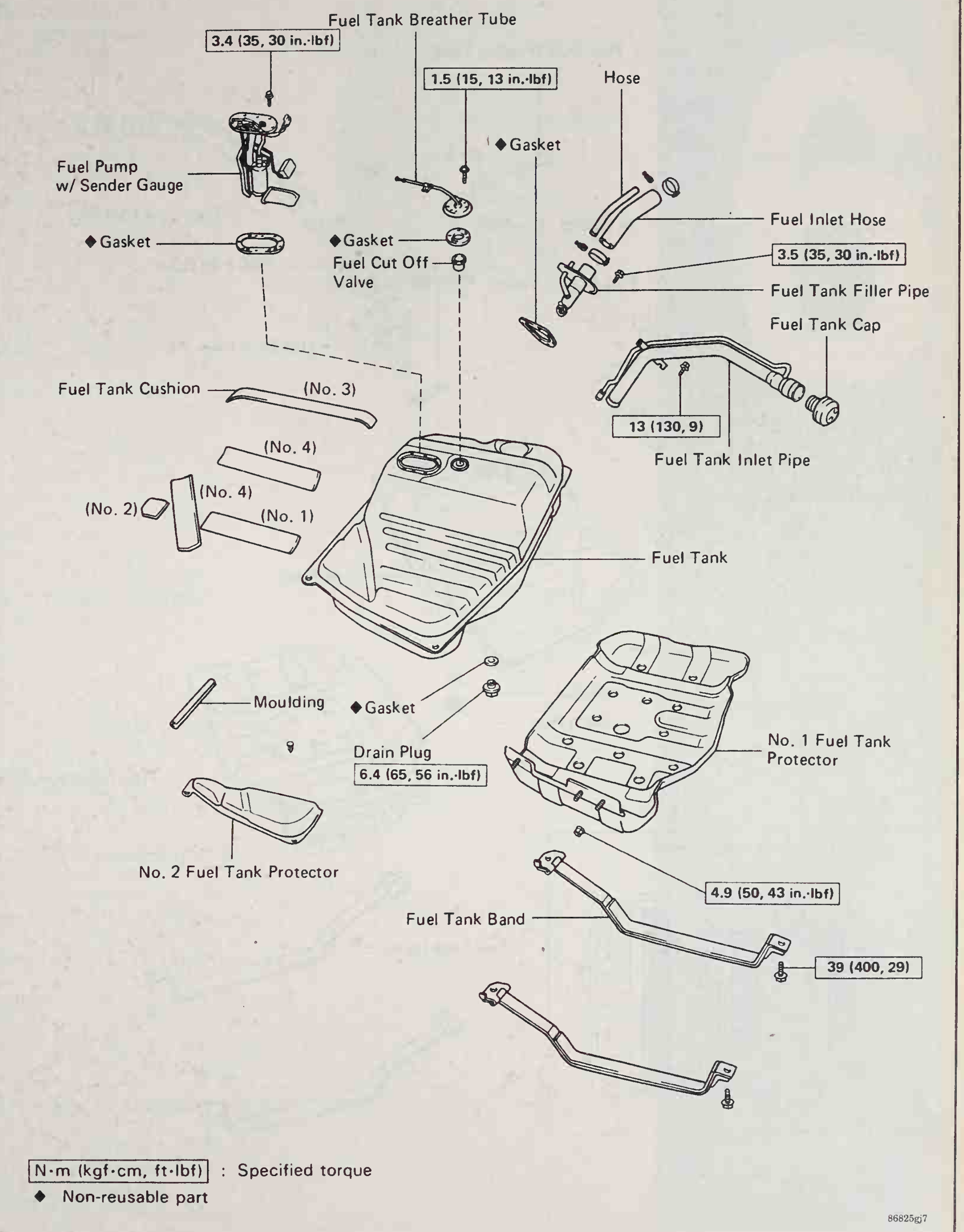

Fuel Tank Breather Tube
3.4 (35, 30 in.·lbf)
1.5 (15, 13 in.·lbf)
Hose
◆Gasket
Fuel Pump
w/ Sender Gauge
Fuel Inlet Hose
◆Gasket
◆Gasket
Fuel Cut Off
Valve
3.5 (35, 30 in.·lbf)
Fuel Tank Filler Pipe
Fuel Tank Cap
Fuel Tank Cushion
(No. 3)
13 (130, 9)
Fuel Tank Inlet Pipe
(No. 4)
(No. 4)
(No. 2)
(No. 1)
Fuel Tank
Moulding
◆Gasket
Drain Plug
6.4 (65, 56 in.·lbf)
No. 1 Fuel Tank
Protector
No. 2 Fuel Tank Protector
4.9 (50, 43 in.·lbf)
Fuel Tank Band
39 (400, 29)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86825gj7

Fig. 169 Exploded view of the fuel tank components — 1992-94 Land Cruiser

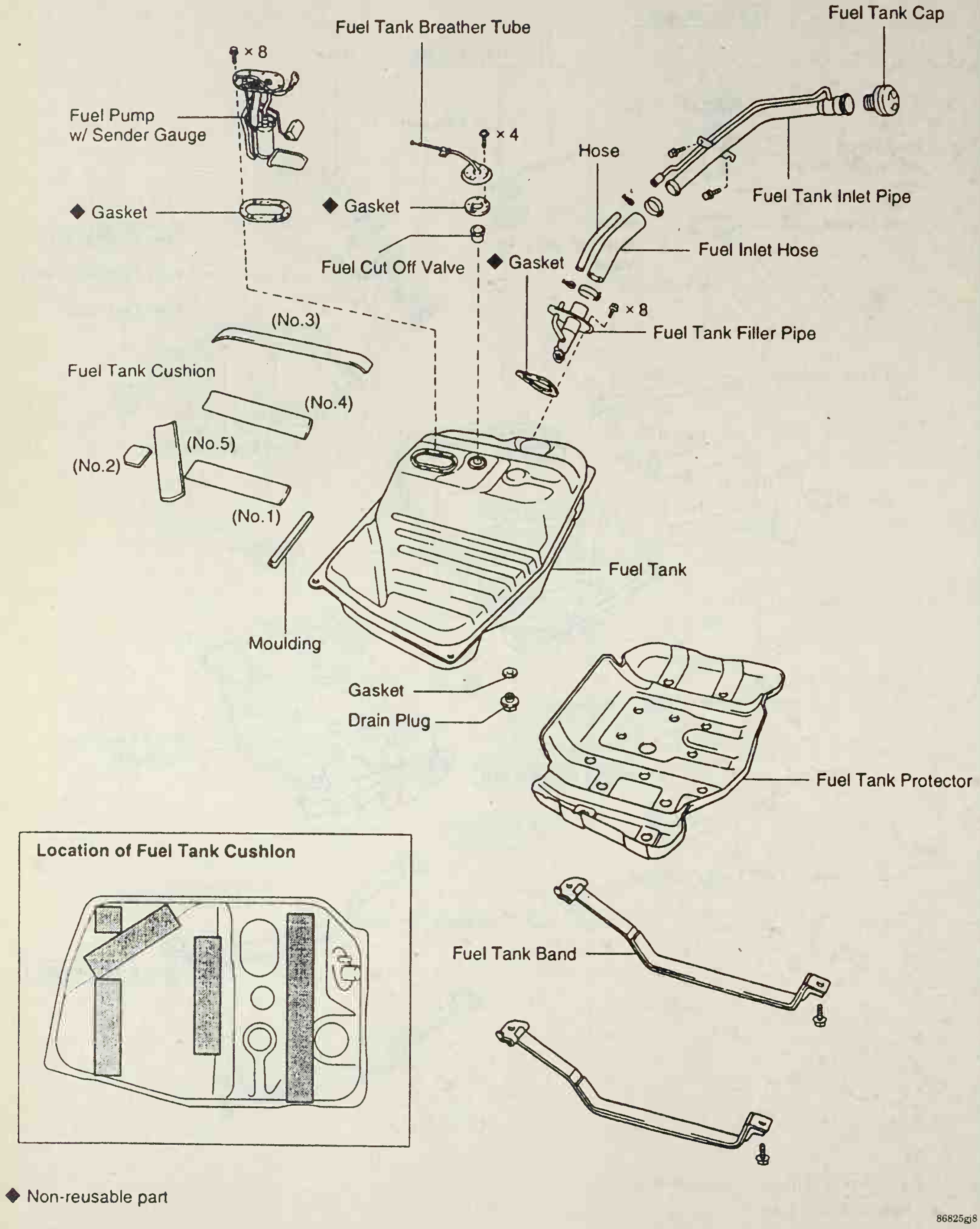

Fuel Tank Breather Tube
Fuel Tank Cap
× 8
Fuel Pump
w/ Sender Gauge
× 4
Hose
Fuel Tank Inlet Pipe
◆ Gasket
◆ Gasket
Fuel Inlet Hose
Fuel Cut Off Valve
◆ Gasket
× 8
Fuel Tank Filler Pipe
(No.3)
Fuel Tank Cushion
(No.4)
(No.5)
(No.2)
(No.1)
Fuel Tank
Moulding
Gasket
Drain Plug
Fuel Tank Protector
Location of Fuel Tank Cushion
Fuel Tank Band
◆ Non-reusable part
86825gj8

Fig. 170 Exploded view of the fuel tank components — 1995-96 Land Cruiser

6

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UNDERSTANDING AND TROUBLESHOOTING ELECTRICAL SYSTEMS

Over the years import and domestic manufacturers have incorporated electronic control systems into their production lines. In fact, electronic control systems are so prevalent that all new cars and trucks built today are equipped with at least one on-board computer. These electronic components (with no moving parts) should theoretically last the life of the vehicle, provided that nothing external happens to damage the circuits or memory chips.

While it is true that electronic components should never wear out, in the real world malfunctions do occur. It is also true that any computer-based system is extremely sensitive to electrical voltages and cannot tolerate careless or haphazard testing/service procedures. An inexperienced individual can literally cause major damage looking for a minor problem by using the wrong kind of test equipment or connecting test leads/connectors with the ignition switch **ON**. When selecting test equipment, make sure the manufacturer's instructions state that the tester is compatible with whatever type of system is being serviced. Read all instructions carefully and double check all test points before installing probes or making any test connections.

The following section outlines basic diagnosis techniques for dealing with automotive electrical systems. Along with a general explanation of the various types of test equipment available to aid in servicing modern automotive systems, basic repair techniques for wiring harnesses and connectors are also given. Read the basic information before attempting any repairs or testing. This will provide the background of information necessary to avoid the most common and obvious mistakes that can cost both time and money. Although the replacement and testing procedures are simple in themselves, the systems are not, and unless one has a thorough understanding of all components and their function within a particular system, the logical test sequence these systems demand cannot be followed. Minor malfunctions can make a big difference, so it is important to know how each component affects the operation of the overall system in order to find the ultimate cause of a problem without replacing good components unnecessarily. It is not enough to use the correct test equipment; the test equipment must be used correctly.

Safety Precautions

✲✲CAUTION

Whenever working on or around any electrical or electronic systems, always observe these general precautions to prevent the possibility of personal injury or damage to electronic components.

- Never install or remove battery cables with the key **ON** or the engine running. Jumper cables should be connected with the key **OFF** to avoid power surges that can damage electronic control units. Engines equipped with computer controlled systems should avoid both giving and getting jump starts due to the possibility of serious damage to components from arcing in the engine compartment if connections are made with the ignition **ON**.
- Always remove the battery cables before charging the battery. Never use a high output charger on an installed battery or attempt to use any type of "hot shot" (24 volt) starting aid.
- Exercise care when inserting test probes into connectors to insure good contact without damaging the connector or spreading the pins. Always probe connectors from the rear (wire) side, NOT the pin side, to avoid accidental shorting of terminals during test procedures.
- Never remove or attach wiring harness connectors with the ignition switch **ON**, especially to an electronic control unit.
- Do not drop any components during service procedures and never apply 12 volts directly to any component (like a solenoid or relay) unless instructed specifically to do so. Some component electrical windings are designed to safely handle only 4 or 5 volts and can be destroyed in seconds if 12 volts are applied directly to the connector.
- Remove the electronic control unit if the vehicle is to be placed in an environment where temperatures exceed approximately 176°F (80°C), such as a paint spray booth or when arc/gas welding near the control unit location.

Understanding Basic Electricity

Understanding the basic theory of electricity makes electrical troubleshooting much easier. Several gauges are used in electrical troubleshooting to see inside the circuit being tested. Without a basic understanding, it will be difficult to understand testing procedures.

THE WATER ANALOGY

Electricity is the flow of electrons — hypothetical particles thought to constitute the basic stuff of electricity. Many people have been taught electrical theory using an analogy with water. In a comparison with water flowing in a pipe, the electrons would be the water. As the flow of water can be measured, the flow of electricity can be measured. The unit of measurement is amperes, frequently abbreviated amps. An ammeter will measure the actual amount of current flowing in the circuit.

Just as the water pressure is measured in units such as pounds per square inch, electrical pressure is measured in volts. When a voltmeter's two probes are placed on two live portions of an electrical circuit with different electrical pressures, current will flow through the voltmeter and produce a reading which indicates the difference in electrical pressure between the two parts of the circuit.

While increasing the voltage in a circuit will increase the flow of current, the actual flow depends not only on voltage, but on the resistance of the circuit. The standard unit for measuring circuit resistance is an ohm, measured by an ohmmeter. The ohmmeter is somewhat similar to an ammeter, but incorporates its own source of power so that a standard voltage is always present.

CIRCUITS

An actual electric circuit consists of four basic parts. These are: the power source, such as a generator or battery; a hot wire, which conducts the electricity under a relatively high voltage to the component supplied by the circuit; the load, such as a lamp, motor, resistor or relay coil; and the ground wire, which carries the current back to the source under very low voltage. In such a circuit the bulk of the resistance exists between the point where the hot wire is connected to the load, and the point where the load is grounded. In an automobile, the vehicle's frame or body, which is made of steel, is used as a part of the ground circuit for many of the electrical devices.

Remember that, in electrical testing, the voltmeter is connected in parallel with the circuit being tested (without disconnecting any wires) and measures the difference in voltage between the locations of the two probes; that the ammeter is connected in series with the load (the circuit is separated at one point and the ammeter inserted so it becomes a part of the circuit); and the ohmmeter is self-powered, so that all the power in the circuit should be off and the portion of the circuit to be measured contacted at either end by one of the probes of the meter.

For any electrical system to operate, it must make a complete circuit. This simply means that the power flow from the battery must make a complete circle. When an electrical component is operating, power flows from the battery to the component, passes through the component causing it to perform it to function (such as lighting a light bulb) and then returns to the battery through the ground of the circuit. This ground is usually (but not always) the metal part of the vehicle on which the electrical component is mounted.

Perhaps the easiest way to visualize this is to think of connecting a light bulb with two wires attached to it to your vehicle's battery. The battery in your vehicle has two posts (negative and positive). If one of the two wires attached to the light bulb was attached to the negative post of the battery and the other wire was attached to the positive post of the battery, you would have a complete circuit. Current from the battery would flow out one post, through the wire attached to it and then to the light bulb, where it would pass through causing it to light. It would then leave the light bulb, travel through the other wire, and return to the other post of the battery.

AUTOMOTIVE CIRCUITS

The normal automotive circuit differs from this simple example in two ways. First, instead of having a return wire from the bulb to the battery, the light bulb return the current to the battery through the chassis of the vehicle. Since the negative battery cable is attached to the chassis and the chassis is made of electrically conductive metal, the chassis of the vehicle can serve as a ground wire to complete the circuit. Secondly, most automotive circuits contain switches to turn components on and off.

Some electrical components which require a large amount of current to operate also have a relay in their circuit. Since these circuits carry a large amount of current, the thickness of the wire in the circuit (gauge size) is also greater. If this large wire were connected from the component to the control switch on the instrument panel, and then back to the component, a voltage drop would occur in the circuit. To prevent this potential drop in voltage, an electromagnetic switch (relay) is used. The large wires in the circuit are connected from the vehicle battery to one side of the relay, and from the opposite side of the relay to the component. The relay is normally open, preventing current from passing through the circuit. An additional, smaller wire is connected from the relay to the control switch for the circuit. When the control switch is turned on, it grounds the smaller wire from the relay and completes the circuit.

SHORT CIRCUITS

If you were to disconnect the light bulb (from the previous example of a light-bulb being connected to the battery by two wires) from the wires and touch the two wires together (please take our word for this; don't try it), the result will be a shower of sparks. A similar thing happens (on a smaller scale) when the power supply wire to a component or the electrical component itself becomes grounded before the normal ground connection for the circuit. To prevent damage to the system, the fuse for the circuit blows to interrupt the circuit — protecting the components from damage. Because grounding a wire from a power source makes a complete circuit — less the required component to use the power — the phenomenon is called a short circuit. The most common causes of short circuits are: the rubber insulation on a wire breaking or rubbing through to expose the current carrying core of the wire to a metal part of the car, or a shorted switch.

Some electrical systems on the vehicle are protected by a circuit breaker which is, basically, a self-repairing fuse. When either of the described events takes place in a system which is protected by a circuit breaker, the circuit breaker opens the circuit the same way a fuse does. However, when either the short is removed from the circuit or the surge subsides, the circuit breaker resets itself and does not have to be replaced as a fuse does.

Troubleshooting

When diagnosing a specific problem, organized troubleshooting is a must. The complexity of a modern automobile demands that you approach any problem in a logical, organized manner. There are certain troubleshooting techniques that are standard:

1. Establish when the problem occurs. Does the problem appear only under certain conditions? Were there any noises, odors, or other unusual symptoms?
2. Isolate the problem area. To do this, make some simple tests and observations; then eliminate the systems that are working properly. Check for obvious problems such as broken wires, dirty connections or split/disconnected vacuum hoses. Always check the obvious before assuming something complicated is the cause.
3. Test for problems systematically to determine the cause once the problem area is isolated. Are all the components functioning properly? Is there power going to electrical switches and motors? Is there vacuum at vacuum switches and/or actuators? Is there a mechanical problem such as bent linkage

or loose mounting screws? Performing careful, systematic checks will often turn up most causes on the first inspection without wasting time checking components that have little or no relationship to the problem.

4. Test all repairs after the work is done to make sure that the problem is fixed. Some causes can be traced to more than one component, so a careful verification of repair work is important in order to pick up additional malfunctions that may cause a problem to reappear or a different problem to arise. A blown fuse, for example, is a simple problem that may require more than another fuse to repair. If you don't look for a problem that caused a fuse to blow, a shorted wire (for example) may go undetected.

Experience has shown that most problems tend to be the result of a fairly simple and obvious cause, such as loose or corroded connectors or air leaks in the intake system. This makes careful inspection of components during testing essential to quick and accurate troubleshooting.

BASIC TROUBLESHOOTING THEORY

Electrical problems generally fall into one of three areas:

- The component that is not functioning is not receiving current.
- The component itself is not functioning.
- The component is not properly grounded.

Problems that fall into the first category are by far the most complicated. It is the current supply system to the component which contains all the switches, relay, fuses, etc.

The electrical system can be checked with a test light and a jumper wire. A test light is a device that looks like a pointed screwdriver with a wire attached to it. It has a light bulb in its handle. A jumper wire is a piece of insulated wire with an alligator clip attached to each end.

If a light bulb is not working, you must follow a systematic plan to determine which of the three causes is the villain.

1. Turn on the switch that controls the inoperable bulb.
2. Disconnect the power supply wire from the bulb.
3. Attach the ground wire to the test light to a good metal ground.
4. Touch the probe end of the test light to the end of the power supply wire that was disconnected from the bulb. If the bulb is receiving current, the test light will go on.

➡If the bulb is one which works only when the ignition key is turned on (turn signal), make sure the key is turned on.

If the test light does not go on, then the problem is in the circuit between the battery and the bulb. As mentioned before, this includes all the switches, fuses, and relays in the system. Turn to a wiring diagram and find the bulb on the diagram. Follow the wire that runs back to the battery. The problem is an open circuit between the battery and the bulb. If the fuse is blown and, when replaced, immediately blows again, there is a short circuit in the system which must be located and repaired. If there is a switch in the system, bypass it with a jumper wire. This is done by connecting one end of the jumper wire to the power supply wire into the switch and the other end of the jumper wire to the wire coming out of the switch. If the test light illuminates with the jumper wire installed, the switch or whatever was bypassed is defective.

➡Never substitute the jumper wire for the bulb, as the bulb is the component required to use the power from the power source.

5. If the bulb in the test light goes on, then the current is getting to the bulb that is not working in the car. This eliminates the first of the three possible causes. Connect the power supply wire and connect a jumper wire from the bulb to a good metal ground. Do this with the switch which controls the bulb works with jumper wire installed, then it has a bad ground. This is usually caused by the metal area on which the bulb mounts to the vehicle being coated with some type of foreign matter.
6. If neither test located the source of the trouble, then the light bulb itself is defective.

The above test procedure can be applied to any of the components of the chassis electrical system by substituting the component that is not working for the light bulb. Remember that for any electrical system to work, all connections must be clean and tight.

TEST EQUIPMENT

➡Pinpointing the exact cause of trouble in an electrical system can sometimes only be accomplished by the use of special test equipment. The following describes different types of commonly used test equipment and explains how to use them in diagnosis. In addition to the information covered below, the tool manufacturer's instructions booklet (provided with the tester) should be read and clearly understood before attempting any test procedures.

Jumper Wires

Jumper wires are simple, yet extremely valuable, pieces of test equipment. They are basically test wires which are used to bypass sections of a circuit. The simplest type of jumper wire is a length of multi-strand wire with an alligator clip at each end. Jumper wires are usually fabricated from lengths of standard automotive wire and whatever type of connector (alligator clip, spade connector or pin connector) that is required for the particular vehicle being tested. The well equipped tool box will have several different styles of jumper wires in several different lengths. Some jumper wires are made with three or more terminals coming from a common splice for special purpose testing. In cramped, hard-to-reach areas it is advisable to have insulated boots over the jumper wire terminals in order to prevent accidental grounding, sparks, and possible fire, especially when testing fuel system components.

Jumper wires are used primarily to locate open electrical circuits, on either the ground (-) side of the circuit or on the hot (+) side. If an electrical component fails to operate, connect the jumper wire between the component and a good ground. If the component operates only with the jumper installed, the ground circuit is open. If the ground circuit is good, but the component does not operate, the circuit between the power feed and component may be open. By moving the jumper wire successively back from the lamp toward the power source, you can isolate the area of the circuit where the open is located. When the component stops functioning, or the power is cut off, the open is in the segment of wire between the jumper and the point previously tested.

You can sometimes connect the jumper wire directly from the battery to the hot terminal of the component, but first make sure the component uses 12 volts in operation. Some electrical components, such as fuel injectors, are designed to operate on about 4 volts and running 12 volts directly to the injector terminals can cause damage.

By inserting an in-line fuse holder between a set of test leads, a fused jumper wire can be used for bypassing open circuits. Use a 5 amp fuse to provide protection against voltage spikes. When in doubt, use a voltmeter to check the voltage input to the component and measure how much voltage is normally being applied.

✱✱CAUTION

Never use jumpers made from wire that is of lighter gauge than that which is used in the circuit under test. If the jumper wire is of too small a gauge, it may overheat and possibly melt. Never use jumpers to bypass high resistance loads in a circuit. Bypassing resistances, in effect, creates a short circuit. This may, in turn, cause damage and fire. Jumper wires should only be used to bypass lengths of wire.

Unpowered Test Lights

The 12 volt test light is used to check circuits and components while electrical current is flowing through them. It is used for voltage and ground tests. Twelve volt test lights come in different styles but all have three main parts; a ground clip, a probe, and a light. The most commonly used 12 volt test lights have pick-type probes. To use a 12 volt test light, connect the ground clip to a good ground and probe wherever necessary with the pick. The pick should be sharp so that it can be probed into tight spaces.

✱✱CAUTION

Do not use a test light to probe electronic ignition spark plug or coil wires. Never use a pick-type test light to probe wiring on computer controlled systems unless specifically instructed to do so. Any wire insulation that is pierced by the test light probe should be taped and sealed with silicone after testing.

Like the jumper wire, the 12 volt test light is used to isolate opens in circuits. But, whereas the jumper wire is used to bypass the open to operate the load, the 12 volt test light is used to locate the presence of voltage in a circuit. If the test light glows, you know that there is power up to that point; if the 12 volt test light does not glow when its probe is inserted into the wire or connector, you know that there is an open circuit (no power). Move the test light in successive steps back toward the power source until the light in the handle does glow. When it glows, the open is between the probe and point which was probed previously.

➠The test light does not detect that 12 volts (or any particular amount of voltage) is present; it only detects that some voltage is present. It is advisable before using the test light to touch its terminals across the battery posts to make sure the light is operating properly.

Self-Powered Test Lights

The self-powered test light usually contains a 1.5 volt penlight battery. One type of self-powered test light is similar in design to the 12 volt unit. This type has both the battery and the light in the handle, along with a pick-type probe tip. The second type has the light toward the open tip, so that the light illuminates the contact point. The self-powered test light is a dual purpose piece of test equipment. It can be used to test for either open or short circuits when power is isolated from the circuit (continuity test). A powered test light should not be used on any computer controlled system or component unless specifically instructed to do so. Many engine sensors can be destroyed by even this small amount of voltage applied directly to the terminals.

Voltmeters

A voltmeter is used to measure voltage at any point in a circuit, or to measure the voltage drop across any part of a circuit. It can also be used to check continuity in a wire or circuit by indicating current flow from one end to the other. Analog voltmeters usually have various scales on the meter dial and a selector switch to allow the selection of different voltages. The voltmeter has a positive and a negative lead. To avoid damage to the meter, always connect the negative lead to the negative (-) side of the circuit (to ground or nearest the ground side of the circuit) and connect the positive lead to the positive (+) side of the circuit (to the power source or the nearest power source). Note that the negative voltmeter lead will always be black and that the positive voltmeter will always be some color other than black (usually red).

Depending on how the voltmeter is connected into the circuit, it has several uses. A voltmeter can be connected either in parallel or in series with a circuit and it has a very high resistance to current flow. When connected in parallel, only a small amount of current will flow through the voltmeter current path; the rest will flow through the normal circuit current path and the circuit will work normally. When the voltmeter is connected in series with a circuit, only a small amount of current can flow through the circuit. The circuit will not work properly, but the voltmeter reading will show if the circuit is complete or not.

Ohmmeters

The ohmmeter is designed to read resistance (which is measured in ohms or Ω) in a circuit or component. Although there are several different styles of ohmmeters, all analog meters will usually have a selector switch which permits the measurement of different ranges of resistance (usually the selector switch allows the multiplication of the meter reading by 10, 100, 1000, and 10,000). A calibration knob allows the meter to be set at zero for accurate measurement. Since all ohmmeters are powered by an internal battery, the ohmmeter can be used as a self-powered test light. When the ohmmeter is connected, current from the ohmmeter flows through the circuit or component being tested. Since the ohmmeter's internal resistance and voltage are known values, the amount of current flow through the meter depends on the resistance of the circuit or component being tested.

The ohmmeter can be used to perform a continuity test for opens or shorts (either by observation of the meter needle or as a self-powered test light), and to read actual resistance in a circuit. It should be noted that the ohmmeter is used to check the resistance of a component or wire while there is no voltage applied to the circuit. Current flow from an outside voltage source (such as the vehicle battery) can damage the ohmmeter, so the circuit or component should be isolated from the vehicle electrical system before any testing is done. Since the ohmmeter uses its own voltage source, either lead can be connected to any test point.

➡When checking diodes or other solid state components, the ohmmeter leads can only be connected one way in order to measure current flow in a single direction. Make sure the positive (+) and negative (-) terminal connections are as described in the test procedures to verify the one-way diode operation.

In using the meter for making continuity checks, do not be concerned with the actual resistance readings. Zero resistance, or any ohm reading, indicates continuity in the circuit. Infinite resistance indicates an open in the circuit. A high resistance reading where there should be none indicates a problem in the circuit. Checks for short circuits are made in the same manner as checks for open circuits except that the circuit must be isolated from both power and normal ground. Infinite resistance indicates no continuity to ground, while zero resistance indicates a dead short to ground.

Ammeters

An ammeter measures the amount of current flowing through a circuit in units called amperes or amps. Amperes are units of electron flow which indicate how fast the electrons are flowing through the circuit. Since Ohms Law dictates that current flow in a circuit is equal to the circuit voltage divided by the total circuit resistance, increasing voltage also increases the current level (amps). Likewise, any decrease in resistance will increase the amount of amps in a circuit. At normal operating voltage, most circuits have a characteristic amount of amperes, called "current draw" which can be measured using an ammeter. By referring to a specified current draw rating, measuring the amperes, and comparing the two values, one can determine what is happening within the circuit to aid in diagnosis. An open circuit, for example, will not allow any current to flow so the ammeter reading will be zero. More current flows through a heavily loaded circuit or when the charging system is operating.

An ammeter is always connected in series with the circuit being tested. All of the current that normally flows through the circuit must also flow through the ammeter; if there is any other path for the current to follow, the ammeter reading will not be accurate. The ammeter itself has very little resistance to current flow and therefore will not affect the circuit, but it will measure current draw only when the circuit is closed and electricity is flowing. Excessive current draw can blow fuses and drain the battery, while a reduced current draw can cause motors to run slowly, lights to dim and other components to not operate properly. The ammeter can help diagnose these conditions by locating the cause of the high or low reading.

Multimeters

Different combinations of test meters can be built into a single unit designed for specific tests. Some of the more common combination test devices are known as Volt/Amp testers, Tach/Dwell meters, or Digital Multimeters. The Volt/Amp tester is used for charging system, starting system or battery tests and consists of a voltmeter, an ammeter and a variable resistance carbon pile. The voltmeter will usually have at least two ranges for use with 6, 12 and/or 24 volt systems. The ammeter also has more than one range for testing various levels of battery loads and starter current draw. The carbon pile can be adjusted to offer different amounts of resistance. The Volt/Amp tester has heavy leads to carry large amounts of current and many later models have an inductive ammeter pickup that clamps around the wire to simplify test connections. On some models, the ammeter also has a zero-center scale to allow testing of charging and starting systems without switching leads or polarity. A digital multimeter is a voltmeter, ammeter and ohmmeter combined in an instrument which gives a digital readout. These are often used when testing solid state circuits because of their high input impedance (usually 10 megohms or more).

The tach/dwell meter that combines a tachometer and a dwell (cam angle) meter is a specialized kind of voltmeter. The tachometer scale is marked to show engine speed in rpm and the dwell scale is marked to show degrees of distributor shaft rotation. In most electronic ignition systems, dwell is determined by the control unit, but the dwell meter can also be used to check the duty cycle (operation) of some electronic engine control systems. Some tach/dwell meters are powered by an internal battery, while others take their power from the vehicle battery in use. The battery powered testers usually require calibration (much like an ohmmeter) before testing.

TESTING

Open Circuits

To use the self-powered test light or a multimeter to check for open circuits, first isolate the circuit from the vehicle's 12 volt power source by disconnecting the battery or wiring harness connector. Connect the test light or ohmmeter ground clip to a good ground and probe sections of the circuit sequentially with the test light. (start from either end of the circuit). If the light is out/or there is infinite resistance, the open is between the probe and the circuit ground. If the light is on/or the meter shows continuity, the open is between the probe and end of the circuit toward the power source.

Short Circuits

By isolating the circuit both from power and from ground, and using a self-powered test light or multimeter, you can check for shorts to ground in the circuit. Isolate the circuit from power and ground. Connect the test light or ohmmeter ground clip to a good ground and probe any easy-to-reach test point in the circuit. If the light comes on or there is continuity, there is a short somewhere in the circuit. To isolate the short, probe a test point at either end of the isolated circuit (the light should be on/there should be continuity). Leave the test light probe engaged and open connectors, switches, remove parts, etc., sequentially, until the light goes out/continuity is broken. When the light goes out, the short is between the last circuit component opened and the previous circuit opened.

➡The battery in the test light and does not provide much current. A weak battery may not provide enough power to illuminate the test light even when a complete circuit is made (especially if there are high resistances in the circuit). Always make sure that the test battery is strong. To check the battery, briefly touch the ground clip to the probe; if the light glows brightly the battery is strong enough for testing. Never use a self-powered test light to perform checks for opens or shorts when power is applied to the electrical system under test. The 12 volt vehicle power will quickly burn out the light bulb in the test light.

Available Voltage Measurement

Set the voltmeter selector switch to the 20V position and connect the meter negative lead to the negative post of the battery. Connect the positive meter lead to the positive post of the battery and turn the ignition switch **ON** to provide a load. Read the voltage on the meter or digital display. A well charged battery should register over 12 volts. If the meter reads below 11.5 volts, the battery power may be insufficient to operate the electrical system properly. This test determines voltage available from the battery and should be the first step in any electrical trouble diagnosis procedure. Many electrical problems, especially on computer controlled systems, can be caused by a low state of charge in the battery. Excessive corrosion at the battery cable terminals can cause a poor contact that will prevent proper charging and full battery current flow.

Normal battery voltage is 12 volts when fully charged. When the battery is supplying current to one or more circuits it is said to be "under load." When everything is off the electrical system is under a "no-load" condition. A fully charged battery may show about 12.5 volts at no load; will drop to 12 volts under medium load; and will drop even lower under heavy load. If the battery is partially discharged the voltage decrease under heavy load may be excessive, even though the battery shows 12 volts or more at no load. When allowed to discharge further, the battery's available voltage under load will decrease more severely. For this reason, it is important that the battery be fully charged during all testing procedures to avoid errors in diagnosis and incorrect test results.

Voltage Drop

When current flows through a resistance, the voltage beyond the resistance is reduced (the larger the current, the greater the reduction in voltage). When no current is flowing, there is no voltage drop because there is no current flow. All points in the circuit which are connected to the power source are at the same voltage as the power source. The total voltage drop always equals the total source voltage. In a long circuit with many connectors, a series of small, unwanted voltage drops due to corrosion at the ccnnectors can add up to a total loss of voltage which impairs the operation of the normal loads in the circuit. The maximum allowable voltage drop under load is critical, especially if there is more than one high resistance problem in a circuit because all voltage drops are cumulative. A small drop is normal due to the resistance of the conductors.

INDIRECT COMPUTATION OF VOLTAGE DROPS

1. Set the voltmeter selector switch to the 20 volt position.
2. Connect the meter negative lead to a good ground.
3. While operating the circuit, probe all loads in the circuit with the positive meter lead and observe the voltage readings. A drop should be noticed after the first load. But, there should be little or no voltage drop before the first load.

DIRECT MEASUREMENT OF VOLTAGE DROPS

1. Set the voltmeter switch to the 20 volt position.
2. Connect the voltmeter negative lead to the ground side of the load to be measured.
3. Connect the positive lead to the positive side of the resistance or load to be measured.
4. Read the voltage drop directly on the 20 volt scale.

Too high a voltage indicates too high a resistance. If, for example, a blower motor runs too slowly, you can determine if perhaps there is too high a resistance in the resistor pack. By taking voltage drop readings in all parts of the circuit, you can isolate the problem. Too low a voltage drop indicates too low a resistance. Take the blower motor for example again. If a blower motor runs too fast in the MED and/or LOW position, the problem might be isolated in the resistor pack by taking voltage drop readings in all parts of the circuit to locate a possibly shorted resistor.

HIGH RESISTANCE TESTING

1. Set the voltmeter selector switch to the 4 volt position.
2. Connect the voltmeter positive lead to the positive post of the battery.
3. Turn on the headlights and heater blower to provide a load.
4. Probe various points in the circuit with the negative voltmeter lead.
5. Read the voltage drop on the 4 volt scale. Some average maximum allowable voltage drops are:
    - FUSE PANEL: 0.7 volts
    - IGNITION SWITCH: 0.5 volts
    - HEADLIGHT SWITCH: 0.7 volts
    - IGNITION COIL (+): 0.5 volts
    - ANY OTHER LOAD: 1.3 volts

➡Voltage drops are all measured while a load is operating; without current flow, there will be no voltage drop.

Resistance Measurement

The batteries in an ohmmeter will weaken with age and temperature, so the ohmmeter must be calibrated or "zeroed" before taking measurements. To zero the meter, place the selector switch in its lowest range and touch the two ohmmeter leads together. Turn the calibration knob until the meter needle is exactly on zero.

➡All analog (needle) type ohmmeters must be zeroed before use, but some digital ohmmeter models are automatically calibrated when the switch is turned on. Self-calibrating digital ohmmeters do not have an adjusting knob, but its a good idea to check for a zero readout before use by touching the leads together. All computer controlled systems require the use of a digital ohmmeter with at least 10 megohms impedance for testing. Before any test procedures are attempted, make sure the ohmmeter used is compatible with the electrical system or damage to the on-board computer could result.

To measure resistance, first isolate the circuit from the vehicle power source by disconnecting the battery cables or the harness connector. Make sure the key is **OFF** when disconnecting any components or the battery. Where necessary, also isolate at least one side of the circuit to be checked in order to avoid reading parallel resistances. Parallel circuit resistances will always give a lower reading than the actual resistance of either of the branches. When measuring the resistance of parallel circuits, the total resistance will always be lower than the smallest resistance in the circuit. Connect the meter leads to both sides of the circuit (wire or component) and read the actual measured ohms on the meter scale. Make sure the selector switch is set to the proper ohm scale for the circuit being tested to avoid misreading the ohmmeter test value.

⁂WARNING

Never use an ohmmeter with power applied to the circuit. Like the self-powered test light, the ohmmeter is designed to operate on its own power supply. The normal 12 volt automotive electrical system current could damage the meter!

Wiring Harnesses

The average automobile contains about ½ mile of wiring, with hundreds of individual connections. To protect the many wires from damage and to keep them from becoming a confusing tangle, they are organized into bundles, enclosed in plastic or taped together and called wiring harnesses. Different harnesses serve different parts of the vehicle. Individual wires are color coded to help trace them through a harness where sections are hidden from view.

Automotive wiring or circuit conductors can be in any one of three forms:

1. Single strand wire
2. Multi-strand wire
3. Printed circuitry

Single strand wire has a solid metal core and is usually used inside such components as alternators, motors, relays and other devices. Multi-strand wire has a core made of many small strands of wire twisted together into a single conductor. Most of the wiring in an automotive electrical system is made up of multi-strand wire, either as a single conductor or grouped together in a harness. All wiring is color coded on the insulator, either as a solid color or as a colored wire with an identification stripe. A printed circuit is a thin film of copper or other conductor that is printed on an insulator backing. Occasionally, a printed circuit is sandwiched between two sheets of plastic for more protection and flexibility. A complete printed circuit, consisting of conductors, insulating material and connectors for lamps or other components is called a printed circuit board. Printed circuitry is used in place of individual wires or harnesses in places where space is limited, such as behind instrument panels.

Since automotive electrical systems are very sensitive to changes in resistance, the selection of properly sized wires is critical when systems are repaired. A loose or corroded connection or a replacement wire that is too small for the circuit will add extra resistance and an additional voltage drop to the circuit. A ten percent voltage drop can result in slow or erratic motor operation, for example, even though the circuit is complete. The wire gauge number is an expression of the cross-section area of the conductor. The most common system for expressing wire size is the American Wire Gauge (AWG) system.

Gauge numbers are assigned to conductors of various cross-section areas. As gauge number increases, area decreases and the conductor becomes smaller. A 5 gauge conductor is smaller than a 1 gauge conductor and a 10 gauge is smaller than a 5 gauge. As the cross-section area of a conductor decreases, resistance increases and so does the gauge number. A conductor with a higher gauge number will carry less current than a conductor with a lower gauge number.

➡Gauge wire size refers to the size of the conductor, not the size of the complete wire. It is possible to have two wires of the same gauge with different diameters because one may have thicker insulation than the other.

12 volt automotive electrical systems generally use 10, 12, 14, 16 and 18 gauge wire. Main power distribution circuits and larger accessories usually use 10 and 12 gauge wire. Battery cables are usually 4 or 6 gauge, although 1 and 2 gauge wires are occasionally used. Wire length must also be considered when making repairs to a circuit. As conductor length increases, so does resistance. An 18 gauge wire, for example, can carry a 10 amp load for 10 feet without excessive voltage drop; however if a 15 foot wire is required for the same 10 amp load, it must be a 16 gauge wire.

An electrical schematic shows the electrical current paths when a circuit is operating properly. It is essential to understand how a circuit works before trying to figure out why it doesn't. Schematics break the entire electrical system down into individual circuits and show only one particular circuit. In a schematic, no attempt is made to represent wiring and components as they physically appear on the vehicle; switches and other components are shown as simply as possible. Face views of harness connectors show the cavity or terminal locations in all multi-pin connectors to help locate test points.

If you need to backprobe a connector while it is on the component, the order of the terminals must be mentally reversed. The wire color code can help in this situation, as well as a keyway, lock tab or other reference mark.

WIRING REPAIR

Soldering is a quick, efficient method of joining metals permanently. Everyone who has the occasion to make wiring repairs should know how to solder. Electrical connections that are soldered are far less likely to come apart and will conduct electricity much better than connections that are only "pig-tailed" together. The most popular (and preferred) method of soldering is with an electrical soldering gun. Soldering irons are available in many sizes and wattage ratings. Irons with higher wattage ratings deliver higher temperatures and recover lost heat faster. A small soldering iron rated for no more than 50 watts is recommended, especially on electrical systems where excess heat can damage the components being soldered.

There are three ingredients necessary for successful soldering; proper flux, good solder and sufficient heat. A soldering flux is necessary to clean the metal of tarnish, prepare it for soldering and to enable the solder to spread into tiny crevices. When soldering, always use a rosin core solder which is non-corrosive and will not attract moisture once the job is finished. Other types of flux (acid core) will leave a residue that will attract moisture and cause the wires to corrode. Tin is a unique metal with a low melting point. In a molten state, it dissolves and alloys easily with many metals. Solder is made by mixing tin with lead. The most common proportions are 40/60, 50/50 and 60/40, with the percentage of tin listed first. Low priced solders usually contain less tin, making them very difficult for a beginner to use because more heat is required to melt the solder. A common solder is 40/60 which is well suited for all-around general use, but 60/40 melts easier and is preferred for electrical work.

Soldering Techniques

Successful soldering requires that the metals to be joined be heated to a temperature that will melt the solder, usually 360-460°F (182-238°C). Contrary to popular belief, the purpose of the soldering iron is not to melt the solder itself, but to heat the parts being soldered to a temperature high enough to melt the solder when it is touched to the work. Melting flux-cored solder on the soldering iron will usually destroy the effectiveness of the flux.

➡Soldering tips are made of copper for good heat conductivity, but must be "tinned" regularly for quick transference of heat to the project and to prevent the solder from sticking to the iron. To "tin" the iron, simply heat it and touch the flux-cored solder to the tip; the solder will flow over the hot tip. Wipe the excess off with a clean rag, but be careful as the iron will be hot.

After some use, the tip may become pitted. If so, simply dress the tip smooth with a smooth file and "tin" the tip again. Flux-cored solder will remove oxides but rust, bits of insulation and oil or grease must be removed with a wire brush or emery cloth. For maximum strength in soldered parts, the joint must start off clean and tight. Weak joints will result in gaps too wide for the solder to bridge.

If a separate soldering flux is used, it should be brushed or swabbed on only those areas that are to be soldered. Most solders contain a core of flux and separate fluxing is unnecessary. Hold the work to be soldered firmly. It is best to solder on a wooden board, because a metal vise will only rob the piece to be soldered of heat and make it difficult to melt the solder. Hold the soldering tip with the broadest face against the work to be soldered. Apply solder under the tip close to the work, using enough solder to give a heavy film between the iron and the piece being soldered, while moving slowly and making sure the solder melts properly. Keep the work level or the solder will run to the lowest part and favor the thicker parts, because these require more heat to melt the solder. If the soldering tip overheats (the solder coating on the face of the tip burns up), it should be retinned. Once the soldering is completed, let the soldered joint stand until cool. Tape and seal all soldered wire splices after the repair has cooled.

Wire Harness Connectors

Most connectors in the engine compartment or that are otherwise exposed to the elements are protected against moisture and dirt which could create oxidation and deposits on the terminals.

These special connectors are weather-proof. All repairs require the use of a special terminal and the tool required to service it. This tool is used to remove the pin and sleeve terminals. If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent or deformed. Unlike standard blade type terminals, these weather-proof terminals cannot be straightened once they are bent. Make certain that the connectors are properly seated and all of the sealing rings are in place when connecting leads. On some models, a hinge-type flap provides a backup or secondary locking feature for the terminals. Most secondary locks are used to improve connector reliability by retaining the terminals if the small terminal lock tangs are not positioned properly.

Molded-on connectors require complete replacement of the connection. This means splicing a new connector assembly into the harness. All splices should be soldered to insure proper contact. Use care when probing the connections or replacing terminals in them as it is possible to short between opposite terminals. If this happens to the wrong terminal pair, it is possible to damage certain components. Always use jumper wires between connectors for circuit checking and never probe through weatherproof seals.

Open circuits are often difficult to locate by sight because corrosion or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may correct the open circuit condition. This should always be considered when an open circuit or a failed sensor is indicated. Intermittent problems may also be caused by oxidized or loose connections. When using a circuit tester for diagnosis, always probe connections from the wire side. Be careful not to damage sealed connectors with test probes.

All wiring harnesses should be replaced with identical parts, using the same gauge wire and connectors. When signal wires are spliced into a harness, use wire with high temperature insulation only. It is seldom necessary to replace a complete harness. If replacement is necessary, pay close attention to insure proper harness routing. Secure the harness with suitable plastic wire clamps to prevent vibrations from causing the harness to wear in spots or contact any hot components.

➡Weatherproof connectors cannot be replaced with standard connectors. Instructions are provided with replacement connector and terminal packages. Some wire harnesses have mounting indicators (usually pieces of colored tape) to mark where the harness is to be secured.

In making wiring repairs, its important that you always replace damaged wires with wiring of the same gauge as the wire being replaced. The heavier the wire, the smaller the gauge number. Wires are color-coded to aid in identification and whenever possible the same color coded wire should be used for replacement. A wire stripping and crimping tool is necessary to install solderless terminal connectors. Test all crimps by pulling on the wires; it should not be possible to pull the wires out of a good crimp.

Wires which are open, exposed or otherwise damaged are repaired by simple splicing. Where possible, if the wiring harness is accessible and the damaged place in the wire can be located, it is best to open the harness and check for all possible damage. In an inaccessible harness, the wire must be bypassed with a new insert, usually taped to the outside of the old harness.

When replacing fusible links, be sure to use fusible link wire, NOT ordinary automotive wire. Make sure the fusible segment is of the same gauge and construction as the one being replaced and double the stripped end when crimping the terminal connector for a good contact. The melted (open) fusible link segment of the wiring harness should be cut off as close to the harness as possible, then a new segment spliced in as described. In the case of a damaged fusible link that feeds two harness wires, the harness connections should be replaced with two fusible link wires so that each circuit will have its own separate protection.

➡Most of the problems caused in the wiring harness are due to bad ground connections. Always check all vehicle ground connections for corrosion or looseness before performing any power feed checks to eliminate the chance of a bad ground affecting the circuit.

Hard-Shell Connectors

Unlike molded connectors, the terminal contacts in hard-shell connectors can be replaced. Weatherproof hard-shell connectors with the leads molded into the shell have non-replaceable terminal ends. Replacement usually involves the use of a special terminal removal tool that depresses the locking tangs (barbs) on the connector terminal and allows the connector to be removed from the rear of the shell. The connector shell should be replaced if it shows any evidence of burning, melting, cracks, or breaks. Replace individual terminals that are burnt, corroded, distorted or loose.

➡The insulation crimp must be tight to prevent the insulation from sliding back on the wire when the wire is pulled. The insulation must be visibly compressed under the crimp tabs, and the ends of the crimp should be turned in for a firm grip on the insulation.

The wire crimp must be made with all wire strands inside the crimp. The terminal must be fully compressed on the wire strands with the ends of the crimp tabs turned in to make a firm grip on the wire. Check all connections with an ohmmeter to insure a good contact. There should be no measurable resistance between the wire and the terminal when connected.

Fusible Links

The fuse link is a short length of special, Hypalon (high temperature) insulated wire, integral with the engine compartment wiring harness and should not be confused with standard wire. It is several wire gauges smaller than the circuit which it protects. Under no circumstances should a fuse link replacement repair be made using a length of standard wire cut from bulk stock or from another wiring harness.

To repair any blown fuse link use the following procedure:

1. Determine which circuit is damaged, its location and the cause of the open fuse link. If the damaged fuse link is one of three fed by a common No. 10 or 12 gauge feed wire, determine the specific affected circuit.
2. Disconnect the negative battery cable.
3. Cut the damaged fuse link from the wiring harness and discard it. If the fuse link is one of three circuits fed by a single feed wire, cut it out of the harness at each splice end and discard it.
4. Identify and procure the proper fuse link with butt connectors for attaching the fuse link to the harness.

➡Heat shrink tubing must be slipped over the wire before crimping and soldering the connection.

5. To repair any fuse link in a 3-link group with one feed:
   a. After cutting the open link out of the harness, cut each of the remaining undamaged fuse links close to the feed wire weld.
   b. Strip approximately ½ in. (13mm) of insulation from the detached ends of the two good fuse links. Insert two wire ends into one end of a butt connector, then carefully push one stripped end of the replacement fuse link into the same end of the butt connector and crimp all three firmly together.

➡Care must be taken when fitting the three fuse links into the butt connector as the internal diameter is a snug fit for three wires. Make sure to use a proper crimping tool. Pliers, side cutters, etc. will not apply the proper crimp to retain the wires and withstand a pull test.

   c. After crimping the butt connector to the three fuse links, cut the weld portion from the feed wire and strip approximately ½ in. (13mm) of insulation from the cut end. Insert the stripped end into the open end of the butt connector and crimp very firmly.
   d. To attach the remaining end of the replacement fuse link, strip approximately ½ in. (13mm) of insulation from the wire end of the circuit from which the blown fuse link was removed, and firmly crimp a butt connector or equivalent to the stripped wire. Then, insert the end of the replacement link into the other end of the butt connector and crimp firmly.
   e. Using rosin core solder with a consistency of 60 percent tin and 40 percent lead, solder the connectors and the wires at the repairs then insulate with electrical tape or heat shrink tubing.
6. To replace any fuse link on a single circuit in a harness, cut out the damaged portion, strip approximately ½ in. (13mm) of insulation from the two wire ends and attach the appropriate replacement fuse link to the stripped wire ends with two proper

size butt connectors. Solder the connectors and wires, then insulate.

7. To repair any fuse link which has an eyelet terminal on one end such as the charging circuit, cut off the open fuse link behind the weld, strip approximately 1/2 in. (13mm) of insulation from the cut end and attach the appropriate new eyelet fuse link to the cut stripped wire with an appropriate size butt connector. Solder the connectors and wires at the repair, then insulate.

8. Connect the negative battery cable to the battery and test the system for proper operation.

➡Do not mistake a resistor wire for a fuse link. The resistor wire is generally longer and has print stating, "Resistor-don't cut or splice."

When attaching a single No. 16, 17, 18 or 20 gauge fuse link to a heavy gauge wire, always double the stripped wire end of the fuse link before inserting and crimping it into the butt connector for positive wire retention.

Add-On Electrical Equipment

The electrical system in your vehicle is designed to perform under reasonable operating conditions without interference between components. Before any additional electrical equipment is installed, it is recommended that you consult your dealer or a reputable repair facility that is familiar with the vehicle and its systems.

If the vehicle is equipped with mobile radio equipment and/or mobile telephone, it may have an effect upon the operation of any on-board computer control modules. Radio Frequency Interference (RFI) from the communications system can be picked up by the vehicle's wiring harnesses and conducted into the control module, giving it the wrong messages at the wrong time. Although well shielded against RFI, the computer should be further protected by taking the following measures:

- Install the antenna as far as possible from the control module. For instance, if the module is located behind the center console area, then the antenna should be mounted at the rear of the vehicle.
- Keep the antenna wiring a minimum of eight inches away from any wiring running to control modules and from the module itself. NEVER wind the antenna wire around any other wiring.
- Mount the equipment as far from the control module as possible. Be very careful during installation not to drill through any wires or short a wire harness with a mounting screw.
- Insure that the electrical feed wire(s) to the equipment are properly and tightly connected. Loose connectors can cause interference.
- Make certain that the equipment is properly grounded to the vehicle. Poor grounding can damage expensive equipment.

BATTERY CABLES

Disconnecting the Cables

⁂WARNING

Make sure the battery cables are connected to the correct battery terminals. Reverse polarity may damage electrical components, particularly the (expensive) engine control unit.

Before performing work on the vehicle, it is usually required to disconnect the battery from the electrical system. Whether this is to prevent a mistaken startup or electrical power from being supplied to the system components, the certain measure is to shut off the power at the source.

To disconnect the battery cable(s), perform the following:

1. Make sure the ignition switch is **OFF**.

➡Disconnecting the negative battery cable FIRST with the ignition turned OFF is required to prevent unwanted surges through the electrical system. If a voltage spike is fed through the system, delicate and expensive componentry (like the engine control unit) could be destroyed in fractions of a second.

2. Use the appropriate size wrench(es) to loosen the hardware on the cable clamps. ALWAYS begin with the negative battery cable.
3. If necessary, use a puller tool designed for battery cable clamps and remove the clamp, then isolate it from the battery terminal.
4. Remove the positive battery cable, if required, once the negative battery cable has been removed.

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

General Information

SYSTEM OPERATION

⁂CAUTION

The 1994-96 Toyota trucks are equipped with a Supplemental Restraint System (SRS), which is comprises of a driver's and passenger's (on some models) air bag. Failure to carry out the service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing the SRS may fail to operate when needed. Before servicing, be sure to read the following items carefully.

When a vehicle is involved in a frontal collision in the hatched area and the shock is larger than a predetermined level, the SRS is activated automatically. A safing sensor is designed to tip at a smaller deceleration rate than the air bag sensor. The ignition is caused when a current flows to the squib, which occurs when a safing sensor and the air bag sensor trip simultaneously. When a deceleration force acts on the sensors, two sqibs in the driver's air bag and passenger's air bag (if applicable) ignite and generate gas. The gas that discharges into the driver's and passenger's air bags rapidly increases the pressure inside the bags, breaking open the steering wheel pad and (if applicable) instrument panel.

Bag inflation then ends, and the bags deflate as the gas is discharged through the holes at the bag's rear or side.

SYSTEM COMPONENTS

Steering Wheel Air Bag

➧ See Figure 1

The inflator and bag of the SRS are stored in the steering wheel pad and cannot be disassembled. The inflator contains a igniter charge, sqib, and gas generate. This inflates the bag when instructed by the center air bag sensor.

Front Passenger Air Bag

➧ See Figure 2

The inflator and bag of the SRS are stored in the instrument panel and cannot be disassembled. The inflator contains a igniter charge, sqib, and gas generate. This inflates the bag when instructed by the center air bag sensor.

Spiral Cable

➧ See Figure 3

The spiral cable is located in the combination switch. This cable is used as an electrical joint from the vehicle body side to the steering wheel.

SRS Warning Light

➧ See Figure 4

The SRS warning light is located on the combination meter. It turns to alert the driver of trouble in the system when a malfunction is detected in the air bag sensor assembly. In normal operating conditions when the ignition switch is turned to the **ON** or **ACC** position, the light turns on for about 6 seconds and then turns off.

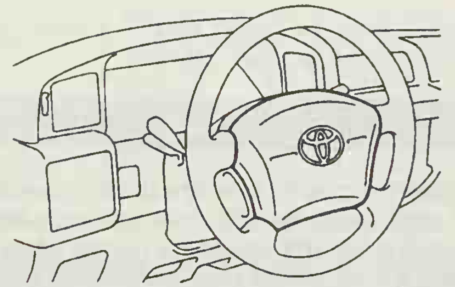


Fig. 1 The air bag is located in the center of the steering wheel

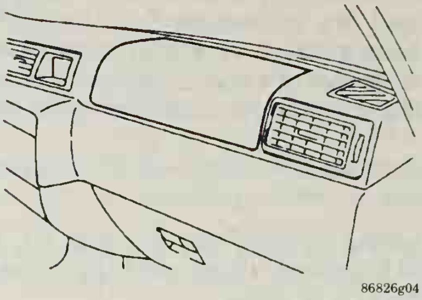


Fig. 2 The passenger's air bag is integrated into the instrument panel

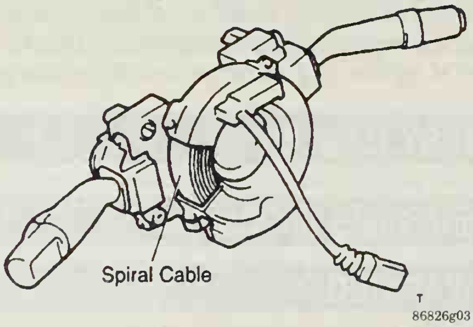


Fig. 3 The spiral cable is wrapped in the combination switch

Air Bag Sensor Assembly

➧ See Figure 5

The air bag sensor assembly is mounted on the floor inside the console box on Land Cruisers, on the air bag sensor cover on Tacoma and inside each fender on the T100. The air bag sensor assembly consists of an air bag sensor, safing sensor, diagnosis circuit and ignition control. It receives signals from the air bag sensors and judges whether the SRS must be activated or not.

SRS Connectors

All connectors in the SRS are colored yellow to distinguish them from the other connectors. These connectors have special functions are specifically designed for the SRS. These connectors use durable gold-platted terminals.

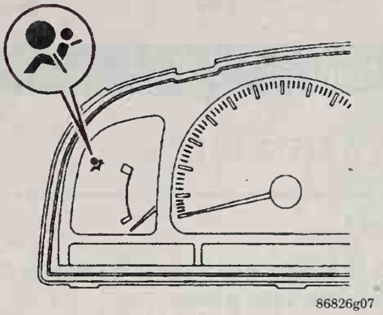


Fig. 4 The SRS warning lamp should light for about six seconds with the key on

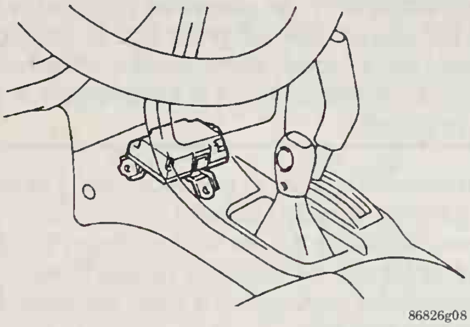


Fig. 5 On Land Cruisers, the air bag sensor is mounted on the floor in the center console

SYSTEM PRECAUTIONS

1. Work must be started after 90 seconds from the time the ignition switch is turned to the **LOCK** position and the negative battery cable has been disconnected. The SRS is equipped with a back-up power source so that if work is started within 90 seconds of disconnecting the negative battery cable, the SRS may deploy. When the negative terminal cable is disconnected from the battery, memory of the clock and radio will be canceled. Before you start working, make a note of the contents memorized by the audio memory system. When you have finished working, reset the audio systems and adjust the clock. Never use a back-up power supply from outside the vehicle.
2. In the event that of a minor frontal collision where the air bag does not deploy, the steering wheel pad, front air bag sensors and center air bag sensor assembly should be inspected.
3. Before repairs, remove the air bag sensors if shocks are likely to be applied to the sensors during repairs.
4. Never disassemble and repair the steering wheel pad, front air bag sensors or center air bag sensors.
5. Do not expose the steering wheel pad, front air bag sensors or center air bag sensor assembly directly to flames or hot air.
6. If the steering wheel pad, front air bag sensors or center air bag sensor assembly have been dropped, or there are cracks, dents or other defects in the case, bracket or connectors, have them replaced with new ones.
7. Information labels are attached to the periphery of the SRS components. Follow the instructions of the notices.
8. After arming the system, check for proper operation of the SRS warning light.
9. If the wiring harness in the SRS system is damaged, have the entire harness assembly replaced.

DISARMING THE SYSTEM

Work must be started only after 90 seconds from the time the ignition switch is turned to the **LOCK** position and the negative battery cable has been disconnected. The SRS is equipped with a back-up power source so that if work is started within 90 seconds of disconnecting the negative battery cable, the SRS may deploy. When the negative terminal cable is disconnected from the battery, memory of the clock and radio will be canceled. Before you start working, make a note of the contents memorized by the audio memory system. When you have finished work, reset the audio systems as before and adjust the clock. To avoid erasing the memory of each system, never use a back-up power supply from outside the vehicle.

ARMING THE SYSTEM

Once the negative battery cable is reconnected, the system is armed. Turn the ignition **ON**. Check that the SRS lamp turns off after about 6 seconds.

HEATER

The heater core is a small heat exchanger located inside the truck, similar to the radiator at the front of the truck. Coolant is circulated from the engine through the heater core and back to the engine. The heater fan blows fresh, outside air through the heater core; the air is heated and sent on to the interior of the truck.

About the only time the heater core will need removal is for replacement due to clogging or leaking. Thankfully, this doesn't happen too often; removing the heater core can be a major task. Some are easier than others, but all require working in unusual positions inside the truck and fitting tools into very cramped quarters behind the dashboard. In some cases, the dashboard must be removed during the procedure, another major project.

**CAUTION

On models equipped with air conditioning, the heater and air conditioner are adjacent but completely separate units. Be certain when working under the dashboard that only the heater hoses are disconnected. The air conditioning hoses are under pressure. If disconnected, the escaping refrigerant will freeze any surface with which it comes in contact, including your skin and eyes.

Blower Motor

REMOVAL & INSTALLATION

▸ See Figure 6

The blower motor and fan is mounted in the bottom of the heater case. Depending on model and equipment, it may be possible to remove the blower without removing the heater case. If there is insufficient clearance below the case to get the motor and fan free, the case must be removed.

1. On Land Cruisers with the 1FZ-FE engine you may need to remove the right side scuff plate to gain access to the motor. Remove the linkage on the lower cover, then remove the cover while pushing the locking protrusion.
2. Disconnect the electrical harness from the blower motor.
3. Disconnect the ductwork from the casing if it will interfere with motor removal. The motor may have a smaller, flexible air exchange hose on it; remove it.
4. Remove the blower motor fasteners and lower the blower motor out of the heater case.

To install:

5. Install the motor into the inlet duct. Be sure to position the motor so that the flexible tube can be attached to the motor and connect it. Install or connect any ductwork removed from the heater case.
6. Connect the electrical lead.

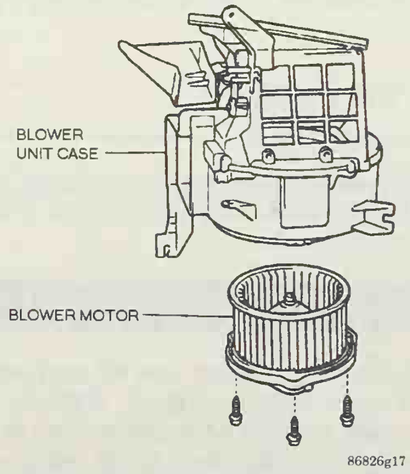


Fig. 6 The blower motor is mounted in the blower unit case. You should be able to see it from under the dash

7. On the 1FZ-FE Land Cruisers, attach the lower cover, linkage and scuff plate.
8. Check the coolant level, add if necessary. Run the heater and check for any leaks.

Heater Unit

REMOVAL & INSTALLATION

▸ See Figure 7

➡Have alot of towels handy for the leakage of coolant that may spill into your interior.

1. Discharge the A/C system (if applicable), using an approved recovery/recycling machine.
2. Remove the cooling unit (if applicable).
3. Drain the cooling system.

**CAUTION

When draining engine coolant, keep in mind that cats and dogs are attracted to ethylene glycol antifreeze and could drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant should be reused unless it is contaminated or is several years old.

4. Disconnect the hoses to the heater core. Tag each one so that it may be correctly reinstalled.
5. On some models you will need to remove the glove box assembly. On others, the instrument panel and reinforcement.
6. At the heater case under the dash, disconnect the ductwork from the case.
7. Disconnect the heater control cables from the heater case. Lift the spring clip holding the control cable to allow the cable to be manipulated. Don't deform or crimp the cables.
8. Disconnect the wiring harness to the blower fan.
9. Remove the three or four bolts holding the heater case to the dash. Because the inlet tubes project through the firewall, the unit will not fall straight down. It will need to be pulled into the passenger compartment and then brought downward.

To install:

10. Lift the case into position and carefully place the inlet and outlet pipes through the firewall. Install the retaining bolts holding the case to the dash.
11. Connect the wiring harness to the blower fan.
12. Connect the control cables to their linkages. Each must be adjusted so that the motion of the dashboard lever causes the correct corresponding motion in the air door. Both the control lever and the door must reach maximum travel at the same time if full function is to be achieved.
    a. Set the dashboard control to FRESH. Lift the adjustment clip and adjust the air inlet cable towards the heater unit until the linkage is at its maximum travel on Pick-Up and 4Runner. For Land Cruiser, adjust the cable away from the case. Release the adjustment clip.
    b. Set the dashboard control to VENT (Pick-Up) or DEF (4Runner and Land Cruiser). Lift the adjustment clip and

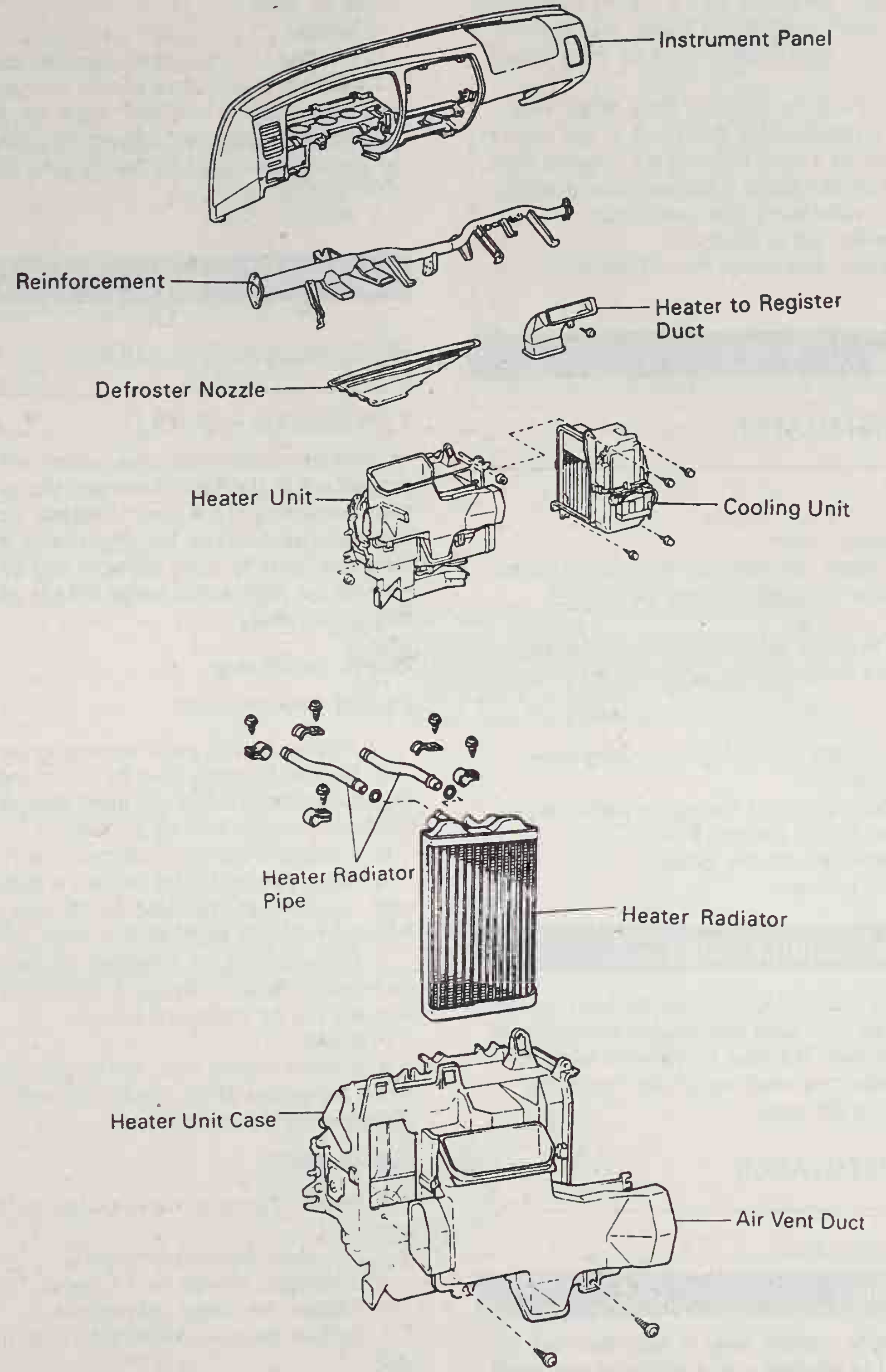

Instrument Panel
Reinforcement
Heater to Register Duct
Defroster Nozzle
Heater Unit
Cooling Unit
Heater Radiator Pipe
Heater Radiator
Heater Unit Case
Air Vent Duct
86826g18

Fig. 7 Exploded view of the heater unit assembly — 1996 4Runner shown

adjust the air flow control cable towards the heater unit until the linkage is at its maximum travel. Release the adjustment clip.

c. Set the temperature control to COOL. Lift the adjustment clip and adjust the air mix control damper control cable away from the heater case until the linkage is at its maximum travel on . For Land Cruiser, adjust the cable towards the case.

13. Connect or reinstall the ductwork. Make certain each tube is firmly and completely fitted on its port. A light spray of glass cleaner serves as a good lubricant; don't use too much.
14. Install the glove box and/or instrument panel assembly.
15. Connect the heater hoses. Use new clamps.
16. Install the cooling unit (if equipped).
17. Refill the coolant, then charge the A/C system (if equipped).

Heater Core

REMOVAL & INSTALLATION

◗ See Figure 7

1. Drain the cooling system.
2. Remove the heater unit assembly. Have alot of towels handy for the leakage of coolant that may spill into your interior.
3. Remove the fasteners securing the core to the unit, remove the plates and clamps. Pull upwards to remove the core from the unit.

To install:

4. Inspect the core fins for any blockage. Using compressed air, clean them.
5. Install the core into the unit placing the plates and clamps into position. Tighten the core screws.
6. Install the heater unit into the vehicle.
7. Fill the cooling system.

Heater Water Control Valve

The heater control valve is located under the hood near the firewall. It is operated by a cable connected to the dashboard temperature control lever. The valve is opened to admit hot coolant into the heater core when the operator moves the lever into the warm or hot range.

REMOVAL & INSTALLATION

1. Drain the engine coolant.

✻✻CAUTION

When draining engine coolant, keep in mind that cats and dogs are attracted to ethylene glycol antifreeze and could drink any that is left in an uncovered container or in puddles on the ground. This will prove fatal in sufficient quantity. Always drain coolant into a sealable container. Coolant should be reused unless it is contaminated or is several years old.

2. Disconnect the control cable from the valve.
3. Disconnect the inlet and outlet hoses from the valve.
4. If equipped, remove the harness connector.
5. If the valve is held by a retaining bolt, remove it and remove the valve.

To install:

6. Reinstall in reverse order. Use new hose clamps.
7. Move the temperature selector lever to COOL. On T100 and Tacoma move it to WARM. Adjust the valve lever to the corresponding position and connect the cable. Lift the spring clip and adjust the cable so that the valve achieves full travel to the closed position.
8. Refill the coolant.

Control Assembly

REMOVAL & INSTALLATION

◗ See Figures 8, 9, 10 and 11

➡These procedures allow the control unit to be pulled forward out of the dash. Generally, this is sufficient to allow inspection of the lever functions, etc. If the control head is to be removed, the cables must be disconnected from each lever. In some cases, it may be easier to disconnect the cable at the heater linkage and pull the cable through the dash.

Pick-Up and 4Runner

EXCEPT 1996 4RUNNER

1. Remove the trim panel surrounding the controls.
2. Remove the knobs from the control levers. These knobs do pull off, although often with great effort. Don't damage anything when exerting force on the knob.
3. If equipped with air conditioning, remove the A/C switch.
4. Use a thin, flat bladed tool with a protected or taped edge. Carefully work the blade into the area at the bottom of the control unit and pry it out.
5. Gently pull the unit forward. If equipped with a clock in the housing, disconnect the clock. Disconnect the lighting harness and pull the control unit forward.

To install:

6. Install in reverse order, making sure the electrical connected are engage before installing the unit. Install the knobs securely and install the trim panel.

1996 4RUNNER

1. Remove the center console cover and the center finish panel.
2. Pull off the heater control knobs.
3. If equipped, remove the A/C switch.
4. Unfasten the control panel screws.
5. Remove the glove compartment door and lower finish panel.
6. Tag and disconnect the heater control cables.
7. Remove the screw and pull out the heater control assembly, then disconnect the harness.

To install:

8. Attach all of the heater cables to their proper locations and adjust if needed.

9. Attach the harness and install the control assembly in the dash.
10. Install the lower finish panel and glove box door.
11. Tighten down the control panel. If equipped, install the A/C switch.
12. Push on the heater knobs, then install the center console cover and center finish panel.

Tacoma and T100

1. Tag and disconnect the heater control cables.
2. Remove the cup holder and the heater control knobs.
3. Pry loose the clip, then remove the A/C switch (if equipped).
4. Remove the instrument panel center lower finish panel. Remove the screws retaining the heater control assembly in the dash, then separate the harnesses from the unit.

To install:

5. Attach all of the heater cables to their proper locations and adjust if needed.

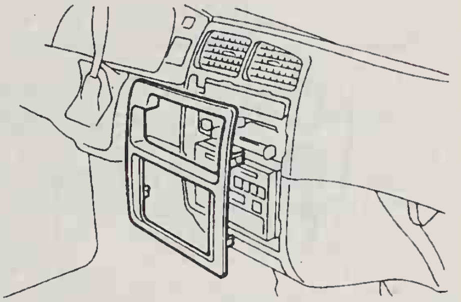


Fig. 10 Remove the trim surrounding the control panel

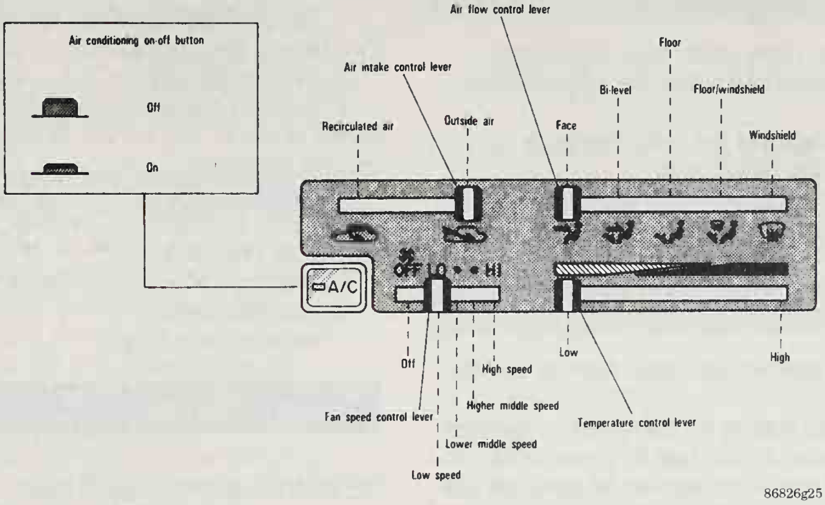

Air conditioning on-off button
Off
On
Air flow control lever
Floor
Air intake control lever
Bi-level
Floor/windshield
Recirculated air
Outside air
Face
Windshield
A/C
OFF LO HI
Off
High speed
Low
High
Higher middle speed
Fan speed control lever
Temperature control lever
Lower middle speed
Low speed
86826g25

Fig. 8 A common heater control panel found on Toyota trucks

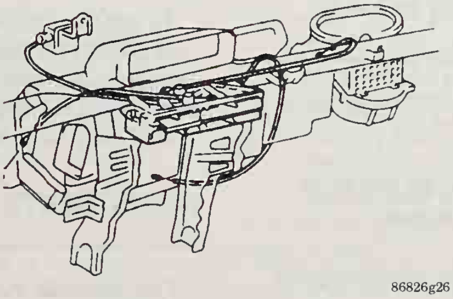


Fig. 9 Tag and disconnect the control cables

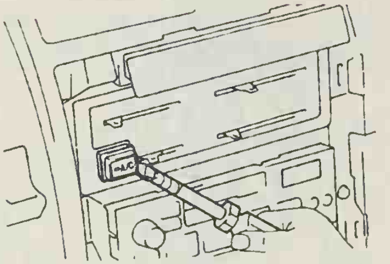


Fig. 11 If removing the A/C switch, tape the end of the tool to prevent marring

6. Attach the harness to the control and slide into the dash, tighten down.
7. Attach the instrument panel center lower finish panel.
8. Install the heater control panel, then the A/C switch if removed.
9. Put the cup holder back into the dash, then push the heater control knobs onto the control arms.
10. Check the operation of the unit, slide the cables to check for tightness.

Land Cruiser

1989-90 MODELS

1. Remove the heater control lever knobs. Remove the ash tray.
2. Remove the 5 screws holding the trim panel surrounding the heater controls. The panel is also held by 2 concealed clips at the lower left and upper right corners; loosen them and remove the trim panel.
3. Unplug any wiring connectors to the trim panel.
4. Remove the four retaining screws. Remove the heater control panel and the spacer.

***WARNING

The trim panel is long and thin; it is easily broken by rough handling.

5. Unplug the wiring connectors and remove the center vent.

To install:

6. Assemble the controller, connect the wiring and fit the assembly into the dash. Install the retaining screws.
7. Install the center vent.
8. Install the trim panel; make certain each clip is correctly seated.
9. Install the ash tray and install the control knobs.

1991-94 MODELS

1. Remove the ashtray. Remove the ashtray holder.
2. Remove the 3 screws holding the lower instrument panel trim. The trim panel is also held by six clips; each must be gently pried loose.
3. Once the panel is loose, unplug the wiring connectors to the switches and remove the panel from the area.
4. Remove the knobs from the heater control levers.
5. Remove the heater faceplate.
6. Remove the four screws and pull the heater control unit forward and out of the dash.

To install:

7. Fit the control unit into the dash and install the retaining screws.
8. Install the faceplate and install the knobs on the controller.
9. Hold the large dash panel in place and engage the wiring connectors to each switch.
10. Install the trim by aligning all the clips at once and gently pushing each into place. Install the retaining screws.
11. Install the ashtray holder and ashtray.

1995-96 MODELS

1. Using a flat-bladded tool, remove the two claw clips, then remove the cup holder.
2. Remove the ashtray.
3. Separate the center cluster finish panel from the heater control assembly. Pull out the control assembly, then disconnect the harnesses.

To install:

4. Attach the harness to the back of the control assembly, then install into the dash.
5. Attach the finish panel to the control assembly.
6. Install the ashtray.
7. Install the cup holder.

Control Cables

REMOVAL & INSTALLATION

1. Remove the control assembly from the dash.
2. Tag and remove the cables from the back of the control assembly.
3. Disconnect the cable from the component it is attached to.

To install:

4. Attach the cable to its appropriate location in the back of the control assembly. Then route it to the appropriate component. Adjust the cable.
5. Check for proper operation.

ADJUSTMENTS

First move the control levers to the left then right. Check for any stiffness and binding through the full range of the levers.

Air Inlet Damper Control

Set the air inlet damper to the FRESH position, then install the control cable and lock the clamp.

Mode Damper Control

Set the mode damper and the control cable to the FACE position on T100, Tacoma, and 1996 4Runner. Set it to DEF on all other models. Clamp the section of the control cable and install the cable to the damper control lever.

Air Mix Damper Control

Set the air mix damper and the control lever to the COOL position or WARM on the Tacoma and T100. Install the control cable and lock the clamp.

Water Valve Control

Set the water valve in the COOL position or WARM on the Tacoma and T100. While pushing the outer cable in the direction, clamp the outer cable to the water valve bracket.

Blower Switch

REMOVAL & INSTALLATION

1. Remove the heater control assembly.
2. Remove the illumination light from the heater control assembly.
3. Using a flat-bladded tool, pry loose the clip and push out the blower speed control switch to the rear of the heater control assembly.

To install:

4. Push the switch into the heater control assembly.
5. Attach the illumination light, then install the control assembly.

AIR CONDITIONER

➡It is recommended, and possibly required by law, that a qualified technician perform the following services.

The air conditioning system consists of several parts to keep it functioning. The compressor, condenser, receiver drier and various hoses just to name a few. Please refer to Section 1 for information and precautions.

⁂WARNING

Some of the vehicles covered by this manual may be equipped with R-134a refrigerant systems, rather than R-12. Be ABSOLUTELY SURE what type of system you are working on before attempting to add refrigerant. Use of the wrong refrigerant or oil will cause damage to the system.

Discharging, evacuating and charging the air conditioning system must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards for the type of system to be serviced.

If you don't have access to the necessary equipment, we recommend that you take your vehicle to a reputable service station to have the work done. If you still wish to perform repairs on the vehicle, have them discharge the system, then take your vehicle home and perform the necessary work. When you are finished, return the vehicle to the station for evacuation and charging. Just be sure to cap ALL A/C system fittings immediately after opening them and keep them protected until the system is recharged.

Compressor

REMOVAL & INSTALLATION

➧ See Figures 12, 13, 14, 15 and 16

The compressor is a large roundish type unit mounted on the engine. The compressor has usually two hoses attached to it.

⁂CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning.

1. Turn the engine **ON** and let it idle for ten minutes with the air conditioning switched ON.
2. Turn the engine **OFF** and disconnect the negative battery cable.
3. Safely discharge the refrigerant from the system, this must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards.
4. Unplug the compressor clutch wire.
5. Disconnect the two refrigerant lines at the compressor. Cap the open fitting immediately to keep moisture out of the system. Discard the old O-rings.
6. Remove the fan shroud, then remove the air conditioning drive belt.
7. For 3VZ-E engines, remove the power steering pump. On some models you will need to remove the engine undercover.
8. Remove the mounting bolts and lift out the compressor. The compressor is heavy; support it before removing the retaining bolts.

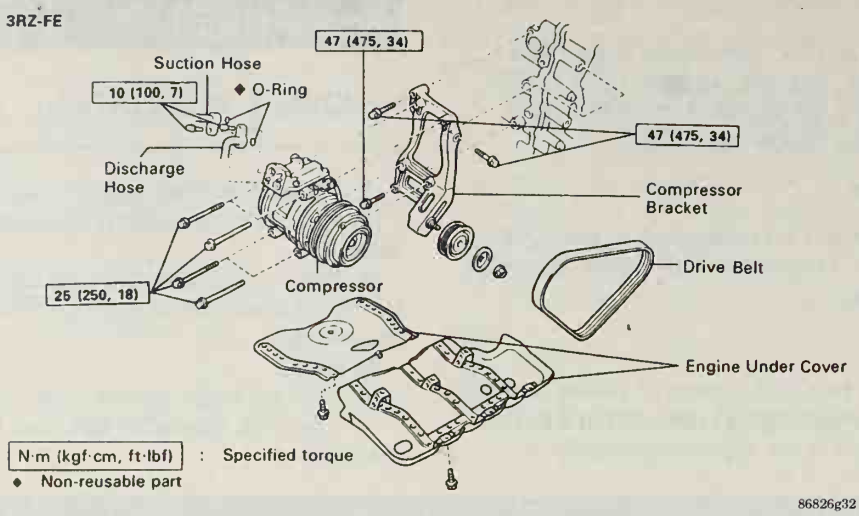

3RZ-FE
47 (475, 34)
Suction Hose
10 (100, 7)
◆ O-Ring
47 (475, 34)
Discharge Hose
Compressor Bracket
Drive Belt
25 (250, 18)
Compressor
Engine Under Cover
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86826g32

Fig. 12 Exploded view of the compressor mounting on the 1996 4Runner with 3RZ-FE engines

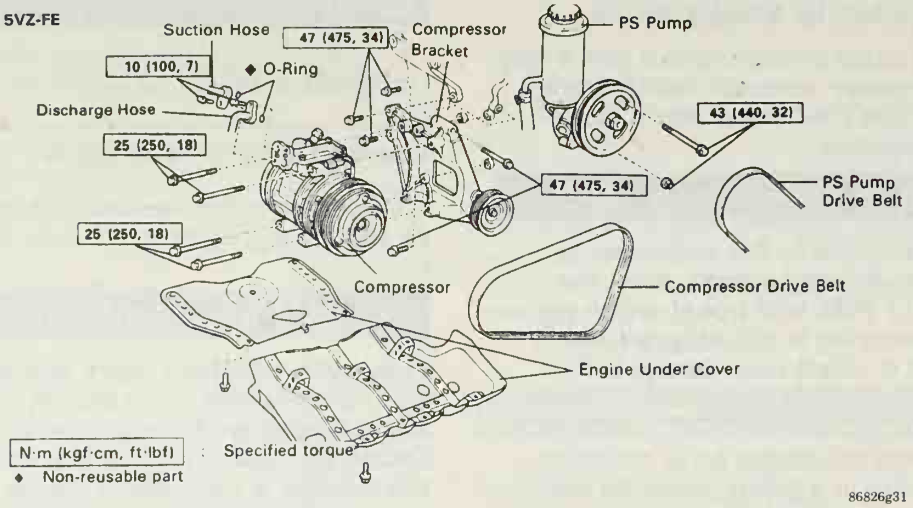

5VZ-FE
Suction Hose
47 (475, 34)
Compressor Bracket
PS Pump
10 (100, 7)
◆ O-Ring
Discharge Hose
43 (440, 32)
25 (250, 18)
47 (475, 34)
PS Pump Drive Belt
25 (250, 18)
Compressor
Compressor Drive Belt
Engine Under Cover
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86826g31

Fig. 13 Exploded view of the compressor mounting on the 1996 4Runner with 5VZ-FE engines

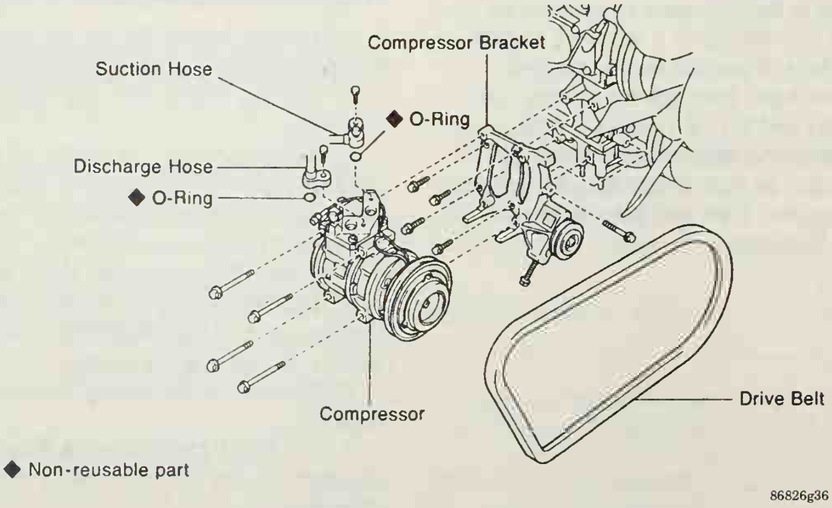

Compressor Bracket
Suction Hose
◆ O-Ring
Discharge Hose
◆ O-Ring
Compressor
Drive Belt
◆ Non-reusable part
86826g36

Fig. 14 Exploded view of the compressor mounting on the Land Cruiser with 1FZ-FE engines

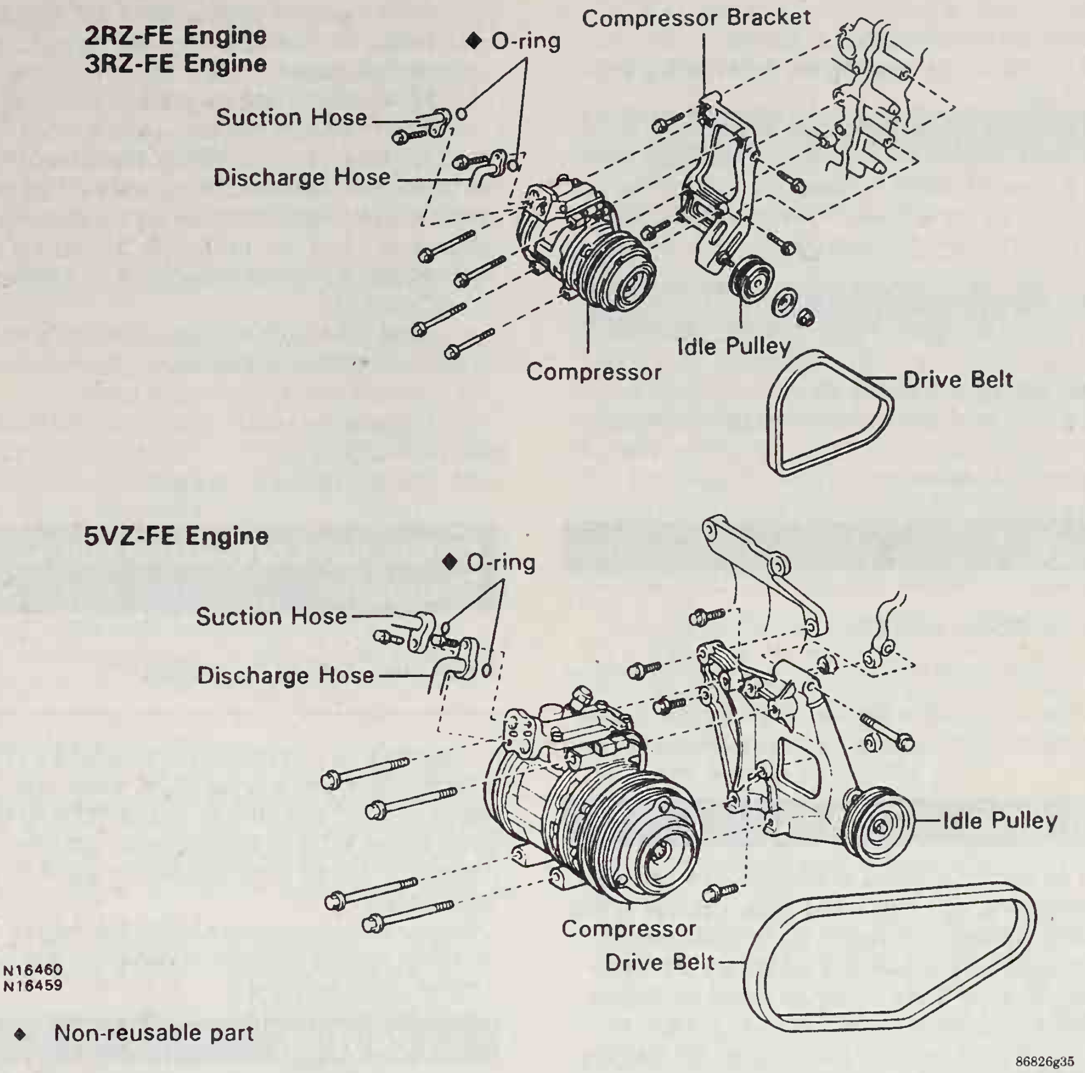

2RZ-FE Engine
3RZ-FE Engine
◆ O-ring
Compressor Bracket
Suction Hose
Discharge Hose
Idle Pulley
Compressor
Drive Belt
5VZ-FE Engine
◆ O-ring
Suction Hose
Discharge Hose
Idle Pulley
Compressor
Drive Belt
N16460
N16459
◆ Non-reusable part
86826g35

Fig. 15 Exploded view of the compressor mountings found on the Tacoma

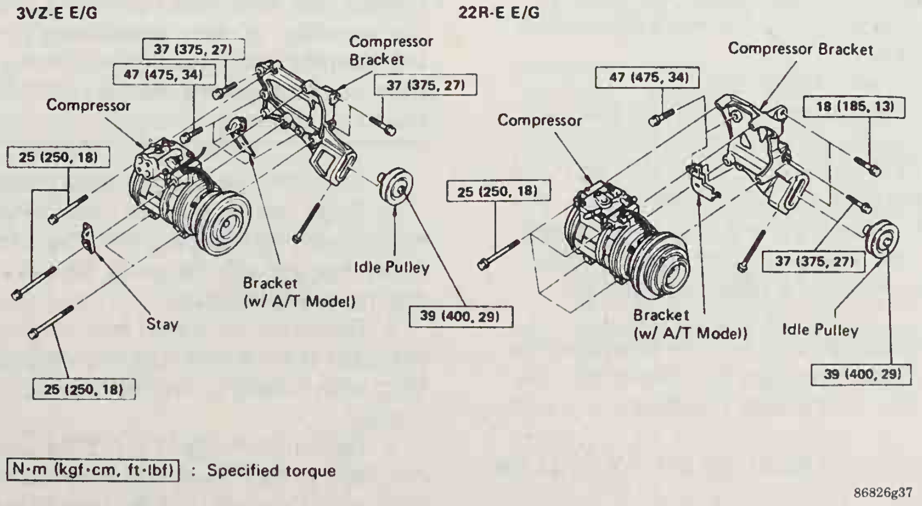

3VZ-E E/G
22R-E E/G
37 (375, 27)
47 (475, 34)
Compressor Bracket
37 (375, 27)
Compressor
25 (250, 18)
Idle Pulley
Bracket (w/ A/T Model)
39 (400, 29)
Stay
25 (250, 18)
47 (475, 34)
Compressor Bracket
18 (185, 13)
Compressor
25 (250, 18)
37 (375, 27)
Bracket (w/ A/T Model)
Idle Pulley
39 (400, 29)
N·m (kgf·cm, ft·lbf) : Specified torque
86826g37

Fig. 16 Exploded view of the compressor mounting on the Pick-Up with 22R-E and 3VZ-E engines

9. Remove the compressor bracket.

To install:

10. Install the compressor bracket to the unit.

11. Install the compressor, then tighten the mounting bolts to 18 ft. lbs. (25 Nm).

12. Install the drive belt and adjust the tension.

13. Install new O-rings to the A/C lines and lubricate them with ND-Oil 8 or an equivalent refrigerant oil. Connect the two refrigerant lines to the compressor. Tighten the suction line to 7-24 ft. lbs. (9-32 Nm) and the discharge line to 7-16 ft. lbs. (9-22 Nm).

14. Connect the compressor clutch wire.

15. Install the power steering pump or engine undercover if removed.

16. Connect the negative battery cable.

17. Evacuate and have an authorized service station charge the system.

18. Inspect the A/C operation.

Condenser

REMOVAL & INSTALLATION

The condenser is located in the front of the engine. It looks like a skinny radiator, and is usually located between the grille and radiator.

✱✱CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning.

1. Properly discharge the refrigerant system, this must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards.

2. Disconnect the negative battery cable.

3. On the Land Cruiser, remove the hood lock brace and the center support brace. On pick-ups remove the grille and hood lock brace. On 1989-95 4Runner, remove the hood lock brace, marker lights and grille. On 1996 models remove the grille, horn, hood lock, center brace and receiver with holder. On the T100, remove the grille, horn, hood lock and center brace. On the Tacoma, remove the grille, hood lock and bumper filler.

4. Disconnect the discharge hose from the condenser inlet fitting. Disconnect the liquid tubes from the receiver/drier. Discard all old O-rings, then cap the lines immediately to prevent entry of dirt.

5. On 4Runner, remove the electric fan and motor from the condenser.

6. Remove the retaining bolts and remove the condenser.

To install:

7. Place the unit in position and install the retaining bolts. Make certain the rubber bushings and supports are present and correctly installed.

8. For 4Runner, install the electric fan.

9. If the condenser has been replace with a new one, add 40-50 cc (1.4-1.7 fl. oz) of ND-Oil 8 or an equivalent refrigerant oil into the condenser. Do not add oil if the original condenser is being reinstalled. Connect the discharge hose, then tighten it to 7-14 ft. lbs. (9-18 Nm). Connect the lines to the receiver, then tighten them only to 48-52 inch lbs. (5-6 Nm). Do not overtighten.

10. Install the hood lock brace, center support, horn, grille, receiver and lighting as necessary.

11. Connect the negative battery cable.

12. Evacuate the system, then have an authorized service station recharge it.

13. Test the system for operation.

Evaporator Core, Expansion Valve and Thermistor

REMOVAL & INSTALLATION

The interior air conditioning components are all contained in a single cooling unit adjacent to the heater case. This is removed as a unit and carefully disassembled on the workbench, giving access to the evaporator, expansion valve, thermostat (thermistor), and on some vehicles, the pressure switch and signal amplifier.

Anytime an air conditioning line is loosened or disconnected, the O-ring must be replaced. Make certain the ring is correctly installed before reassembly.

✱✱CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning.

1. Disconnect the negative battery cable.

2. Safely discharge the air conditioning system, this must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards.

3. Disconnect the suction hose (large hose) at the cooling unit outlet at the firewall. Use two wrenches to counterhold the fitting while loosening. Cap the hose to keep out dirt and moisture.

4. Disconnect the liquid line (small tube) at the cooling unit inlet fitting at the firewall. Use two wrenches to counterhold the fitting while loosening. Cap the hose to keep out dirt and moisture.

5. Remove the grommet(s) from around the fittings.

6. Inside the vehicle, remove the glove box.

7. Unplug the electrical connectors.

8. Remove the hardware holding the cooling unit. Pay attention to which nut, bolt or screw came out of each location; exact reinstallation is required. Pull the case back from the firewall and then lower it. Place the unit upright on a workbench.

9. Remove or disconnect any external wiring on the case of the unit. On 4WD trucks with 3VZ-E and automatic transmission, remove the cut-off relay from the bottom of the cooling unit case.

10. Remove the clips holding the two halves together. Remove the screws.

11. Carefully lift the upper half of the case off the unit.

12. Carefully unplug and remove the thermistor from the unit.

13. Remove the lower case.

14. If desired, disconnect the liquid tube from the inlet fitting of the expansion valve. Remove the insulation and heat sensing tube from the suction tube.

15. Disconnect the expansion valve. Use two wrenches and don't bend the pipes.

16. Inspect the evaporator core, looking for bent fins. If the core is clogged, clean it with compressed air or a soft, dry brush. Never use water to clean the core. Closely inspect the threaded fittings for any sign of cracking or deformation.

To install:

17. Assemble the unit as follows:

    a. For Land Cruiser and pick-ups, connect the expansion valve to the inlet fitting of the evaporator. Make certain a new O-ring (lubed) is placed on the tube fitting, then tighten the nut. Connect the liquid tube to the inlet fitting of the expansion valve; tighten the nut. For Land Cruiser, install the thermistor onto the evaporator.

    b. For 4Runner, install the expansion valve, suction and liquid tubes to the evaporator, using new O-rings. Tighten the fittings. Install the holder to the tubes with the heat sensing tube.

    c. Install the lower unit case onto the evaporator.

    d. Install the thermistor.

    e. Install the upper case on the unit. Install the clips and hardware in their exact original locations.

    f. Install the wiring harness. Double check the connectors for correct placement and secure fit.

18. Lift the cooling unit into place and secure the retaining nuts, bolts and screws. On Land Cruiser, its easier to connect the wire harness before lifting the unit into place. Make certain the harness is not pinched during installation.

19. Connect the wiring harness.

20. Install the glove box.

21. Under the hood, install the grommet(s) on the cooling unit fittings. Make certain the grommet(s) fit correctly.

22. Connect the liquid tube to the cooling unit inlet and tighten the fitting.

23. Connect the suction hose to the outlet fitting and tighten the fitting.

24. Connect the negative battery cable.

25. Evacuate the air conditioning system.

26. Have an authorized service station recharge the system, operate it and check for leaks.

Receiver/Drier

REMOVAL & INSTALLATION

⁂CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning.

The receiver/drier is located under the hood, generally near the condenser at the front of the vehicle. Before removal, inspect the sight glass, fusible plug and line fittings for signs of leakage. A leak will leave light traces of ND-Oil 8 or an equivalent refrigerant oil; the oil in turn will collect and hold dirt, making the area easy to find.

1. Safely discharge the air conditioning system. This must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards.

2. On some models you may need to remove the battery. Always disconnect the negative terminal first.

3. Disconnect the two liquid tubes from the receiver/drier.

4. Remove the unit from its holder.

5. The unit cannot be repaired; it must be replaced. Always replace the receiver/drier if the system has been open or discharged for any length of time. Moisture within the system can render the drier element useless.

To install:

6. Place the receiver/drier into its holder and secure it.

7. Install new O-rings lubricated with ND-Oil 8 or an equivalent refrigerant oil to the liquid lines. Connect the two liquid lines, then tighten the fittings to 7-10 ft. lbs. (9-13 Nm).

8. If the receiver was replaced with a new unit, add 10-20cc (0.35-0.7 oz) of ND-Oil 8 or an equivalent refrigerant oil to the compressor.

9. Install the battery if removed, connect the negative battery terminal first.

10. Evacuate the system.

11. Have an authorized service station recharge the system with refrigerant. Operate the system and check for leaks.

Pressure Switch

REMOVAL & INSTALLATION

✲✲CAUTION

Please refer to Section 1 before discharging the compressor or disconnecting air conditioning lines. Damage to the air conditioning system or personal injury could result. Consult your local laws concerning refrigerant discharge and recycling. In many areas it may be illegal for anyone but a certified technician to service the A/C system. Always use an approved recovery station when discharging the air conditioning.

1. Safely discharge the system this must be performed by a properly trained and certified mechanic in a facility equipped with refrigerant recovery/recycling equipment that meets SAE standards.
2. Separate the harness from the switch.
3. Hold the switch mount on the tube with an open end wrench. Remove the switch with another wrench; be careful not to deform the tube. Discard the O-ring.

To install:

4. Install a new O-ring lubricated with compressor oil ND-Oil 8 or an equivalent to the liquid tube.
5. Install the switch to the tube, then tighten on the tube to 7 ft. lbs. (10 Nm).
6. Attach the harness to the switch.
7. Evacuate the system.
8. Have an authorized service station recharge the system with refrigerant. Operate the system and check for leaks.

Refrigerant Lines

REMOVAL & INSTALLATION

1. Properly discharge the air conditioning system using recovery/recycling equipment.
2. Disconnect the negative battery cable.
3. Unscrew the desired line from its adjoining component. If the lines are connected with flare nuts, use a back-up wrench when disassembling. Cover the exposed ends of the lines to minimize contamination.
4. Remove the lines and discard the O-rings.

To install:

5. Coat the O-rings with refrigerant oil and connect the refrigerant lines. Use a back-up wrench to tighten the fittings.
6. Evacuate and recharge the air conditioning system.

A/C Amplifier

REMOVAL & INSTALLATION

➧ See Figure 17

1. Remove the glove box or the glove box door.
2. Disconnect the amplifier harness.
3. Unbolt the amplifier from the cooling unit.

To install:

4. Install the A/C amplifier to the cooling unit.
5. Attach the electrical harness to the back of the unit.
6. Install the glove box or glove box door.

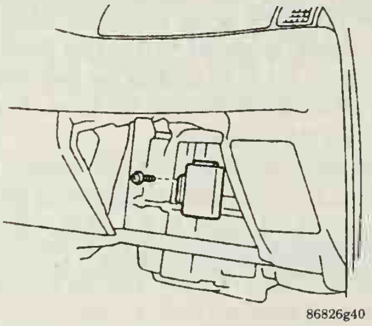


Fig. 17 The A/C amplifier is located behind the glove box

AUXILIARY HEATER

Certain Land Cruiser and 4Runner models may be equipped with an additional heating unit for the rear of the vehicle. These small units contain an additional heater core, fan and blower motor. Coolant hoses or pipes run to either the underdash heater or the engine piping under the hood. The Land Cruiser unit is located under the right front seat; the 4Runner unit is located at the rear of the center console.

Blower Motor

REMOVAL & INSTALLATION

Land Cruiser

1. Disconnect the negative battery cable.
2. Remove the right front seat.
3. Separate the connectors from the blower motor and the rear heater relay.
4. Remove the bolt and the rear heater relay.
5. Remove the screw retaining the side cover.

6. Remove the bolt and 7 screws, then the upper cover with the motor. Remove the screw retaining the motor from the cover.

7. Remove the nut holding the cage to the motor, then separate the cage from the unit.

To install:

8. Attach the cage to the motor with the mounting nut.

9. Secure the blower motor to the upper cover and install it into the vehicle.

10. Attach the side cover. Install the rear heater relay.

11. Install the harness connection to the motor.

12. Check all connections are secure, then install the right front seat.

13. Connect the negative battery cable.

4Runner

1. Disconnect the negative battery cable.
2. Remove the rear heater unit from the vehicle.
3. Remove the wire harness clamps.
4. Remove the screws and clamp securing the case halves.
5. Remove the motor attaching screws, then lift out the motor.
6. Remove the nut holding the cage to the motor, then separate the cage from the unit.

To install:

7. Attach the cage to the motor with the mounting nut.
8. Install the motor into the heater case.
9. Install the heater cases together, then attach the wire harness clamps.
10. Install the rear heater unit into the vehicle.
11. Connect the negative battery cable.
12. Check the operation of the system.

Rear Blower Resistor

REMOVAL & INSTALLATION

Land Cruiser

1. Remove the right front seat.
2. Disconnect the resistor wiring harness.
3. Remove the mounting screws and the resistor.

To install:

4. Install the resistor, then attach the harness wiring to the unit.
5. Install the front seat.

4Runner

EXCEPT 1996 MODELS

1. Remove the console box.
2. Disconnect the wiring harness from the resistor.
3. Remove the mounting screws from the resistor, then the resistor.

To install:

4. Install the resistor, then attach the harness wiring to the unit.
5. Install the console box.

1996 MODELS

1. Remove the front seats.
2. Roll up the carpet.
3. Disconnect the resistor wiring harness.
4. Remove the mounting screws and the resistor.

To install:

5. Install the resistor, then attach the harness wiring to the unit.
6. Roll the carpet into place, then install the front seats.

Air Inlet Servomotor

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the glove box compartment door.
3. Set the damper to the RECIRC position.
4. Disconnect the air inlet servomotor wiring.
5. Disconnect the linkage from the air inlet servomotor.
6. Remove the mounting screws and the air inlet servomotor.

To install:

7. Install the air inlet servomotor, tighten the mounting screws until snug.
8. Connect the linkage to the air inlet servomotor.
9. Attach the air inlet servomotor harness.
10. Install the glove compartment door.
11. Connect the negative battery cable.

Air Mix Servomotor

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the instrument panel.
3. Disconnect the air mix servomotor wiring.
4. Disconnect the linkage from the air mix servomotor.
5. Remove the mounting screws and the air mix servomotor.

To install:

6. Install the air mix servomotor, tighten the mounting screws until snug.
7. Connect the linkage to the air mix servomotor.
8. Attach the air mix servomotor harness.
9. Install the instrument panel.
10. Connect the negative battery cable.

Air Outlet Servomotor

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the instrument lower finish panel.
3. Disconnect the air outlet servomotor wiring.
4. Disconnect the linkage from the air outlet servomotor.

5. Remove the mounting screws and the air outlet servomotor.

To install:

6. Install the air outlet servomotor, tighten the mounting screws until snug.
7. Connect the linkage to the air outlet servomotor.
8. Attach the air outlet servomotor harness.
9. Install the instrument lower finish panel.
10. Connect the negative battery cable.

Rear Heater Unit

➧ **See Figure 18**

REMOVAL & INSTALLATION

Land Cruiser

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Set the temperature control valve to COOL.
4. Remove the right front seat.
5. Disconnect the hoses running to the auxiliary heater. Have a pan and rags handy to contain drainage from the core and hoses.
6. Disconnect the wiring harness running to the unit.
7. Remove the retaining bolts holding the unit to the vehicle; remove the heater unit. Place the unit on the workbench.
8. Remove the clips and screws securing the case halves. Separate the case.
9. Remove the core from the case. The blower motor and fan may be removed if desired.

To install:

10. Place the core into the case, making certain the insulation and supports are in place. Install the blower fan if it was removed.
11. Assemble the case halves.
12. Install the unit into the vehicle. Make certain the inlet and outlet pipes are correctly placed in the grommets. Tighten the retaining screws.
13. Connect the wiring harness.
14. Install the hoses, using new clamps.
15. Install the right front seat.
16. Connect the negative battery cable.
17. Fill the cooling system.
18. Set the heater temperature control to HOT. Start and run the engine for 1 or 2 minutes, but no more.
19. Stop the engine. Inspect the coolant level in the radiator and top off the coolant as necessary.
20. Restart the engine and warm it fully; operate the auxiliary heater and check its function. Inspect the hose joints for leaks.
21. Check the coolant level in the overflow reservoir and top off as necessary. Do NOT remove the radiator cap on a hot engine.

4Runner

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Set the heater temperature control to COOL.
4. You will need to lift up the carpet on some models.
5. Remove the rear center console box. Be careful lifting it away from its mountings; disconnect the wiring harness from the rear controls as soon as access is gained.
6. Disconnect the hoses from the auxiliary heater unit.
7. Remove the rear heater ducts and control assembly.
8. Remove the retaining hardware securing the heater unit and remove the unit.
9. Separate the case halves and remove the heater core. Remove the blower fan and motor if desired.

To install:

10. Assemble the heater core and blower motor into the case.
11. Attach the case halves.
12. Install the heater unit and install the retaining hardware.
13. Attach the rear heater ducts and control assembly.
14. Use new clamps and connect the heater hoses.
15. Install the console, connecting the wiring harness before the console is in its final position.
16. Fill the cooling system.
17. Set the heater temperature control to HOT. Start and run the engine for 1 or 2 minutes, but no more.
18. Stop the engine. Inspect the coolant level in the radiator and top off the coolant as necessary.
19. Restart the engine and warm it fully; operate the auxiliary heater and check its function. Inspect the hose joints for leaks.
20. Check the coolant level in the overflow reservoir and top off as necessary. Do NOT remove the radiator cap on a hot engine.

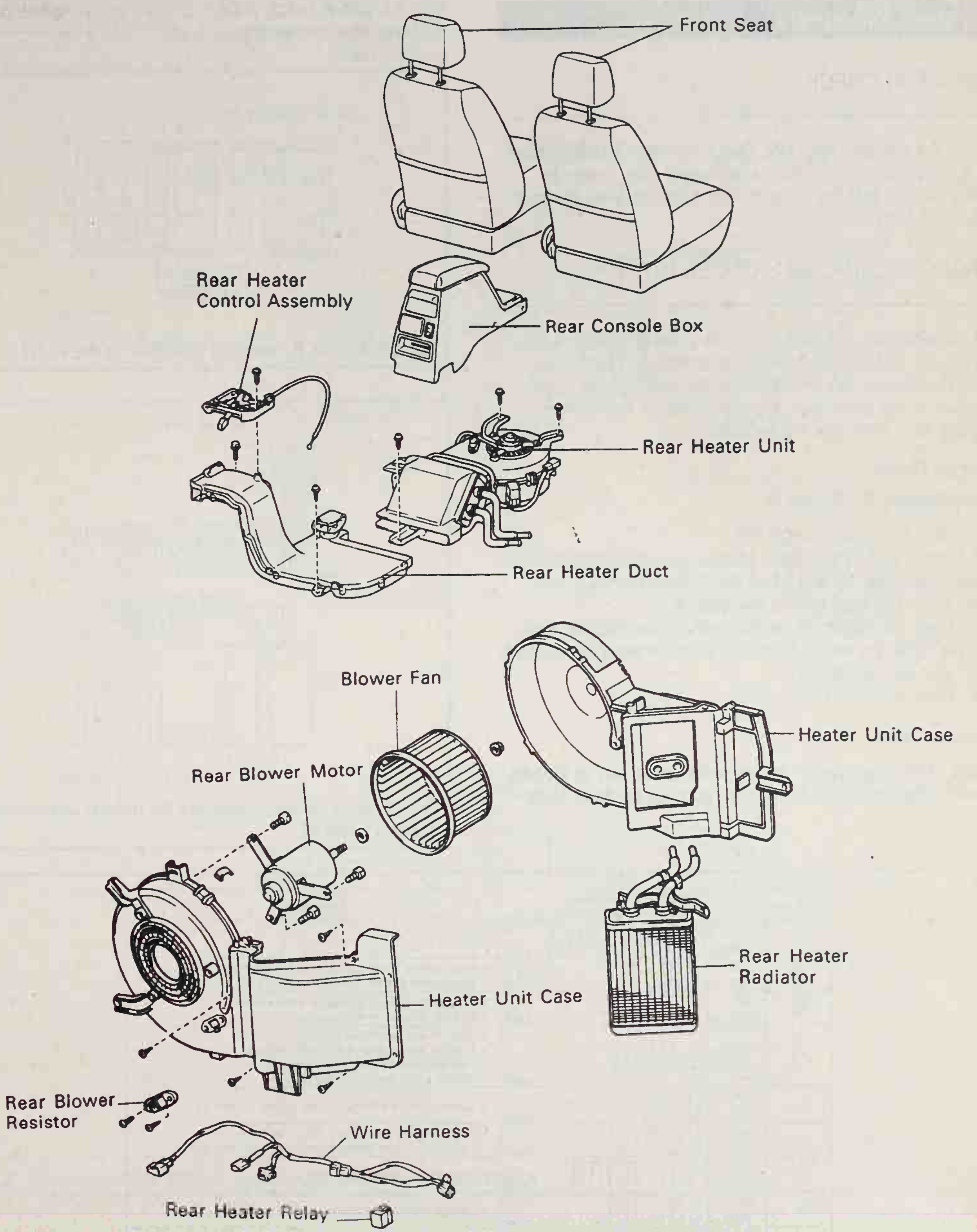

Front Seat
Rear Heater Control Assembly
Rear Console Box
Rear Heater Unit
Rear Heater Duct
Blower Fan
Heater Unit Case
Rear Blower Motor
Rear Heater Radiator
Heater Unit Case
Rear Blower Resistor
Wire Harness
Rear Heater Relay
86826g42

Fig. 18 Exploded view of the 4Runner rear heater assembly — 1996 shown

CRUISE CONTROL

System Diagnosis

INDICATOR CHECK

Turn the ignition switch **ON**. Check that the CRUISE indicator light comes on when the cruise control main switch is turned on, and that the indicator light turns off when the main switch is turned off.

DIAGNOSTIC TROUBLE CODES (DTC)

If a malfunction occurs in the system during cruise control driving, the ECM cancels the cruise control, and blinks the CRUISE indicator light 5 times to inform the driver of a malfunction. At the same time, the malfunction is stored in the memory as a diagnostic trouble code.

Reading Codes

➧ See Figures 19, 20 and 21

1. Turn the ignition switch **ON**.
2. Using SST 09843-18020 or an equivalent jumper wire, connect terminals TC and E1 of the DLC1. The DLC1 is located under the hood next to the fusebox.
3. Read the diagnostic trouble code on the CRUISE indicator light. Write the codes down and compare them to the chart.
4. Turn the ignition **OFF**.
5. Disconnect the jumper wire.

Clearing Codes

After completing repairs, the diagnostic code can be cleared by removing the ECM-B fuse for 10 seconds or more. Make sure the ignition switch is **OFF**. Check that the normal code is displayed after connecting the fuse.

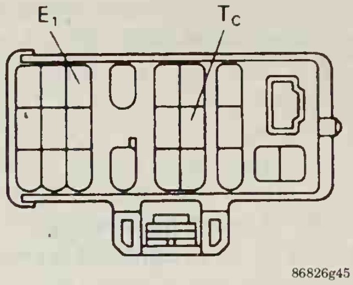


Fig. 19 Tc and E1 terminal locations in the DLC1

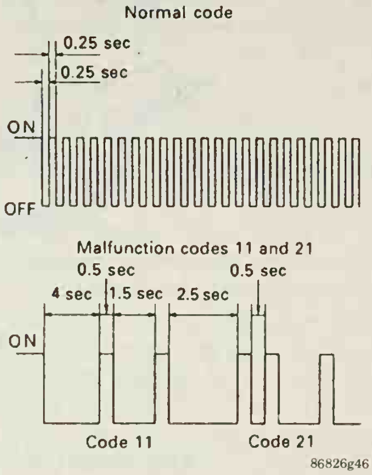
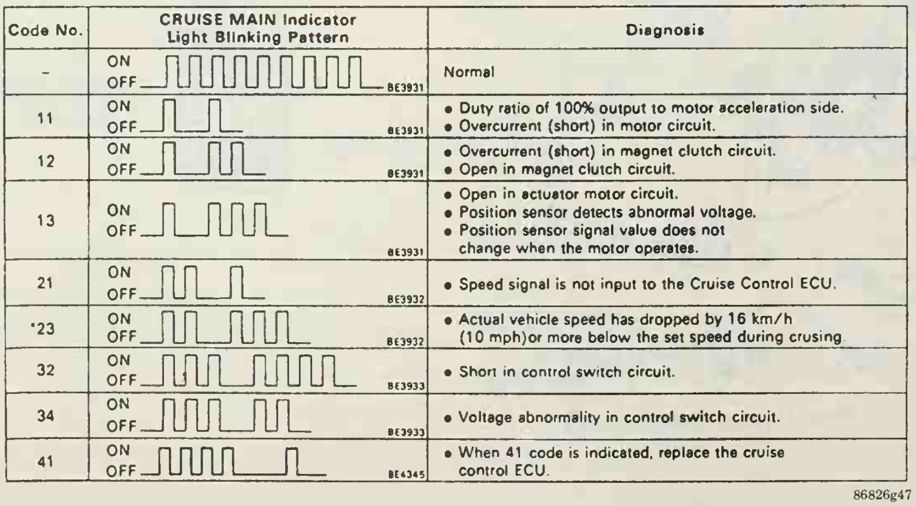


Fig. 20 Blink pattern examples for normal system and codes 11 and 21



Code No.	CRUISE MAIN Indicator Light Blinking Pattern	Diagnosis
–	ON OFF BE3931	Normal
11	ON OFF BE3931	• Duty ratio of 100% output to motor acceleration side. • Overcurrent (short) in motor circuit.
12	ON OFF BE3931	• Overcurrent (short) in magnet clutch circuit. • Open in magnet clutch circuit.
13	ON OFF BE3931	• Open in actuator motor circuit. • Position sensor detects abnormal voltage. • Position sensor signal value does not change when the motor operates.
21	ON OFF BE3932	• Speed signal is not input to the Cruise Control ECU.
*23	ON OFF BE3932	• Actual vehicle speed has dropped by 16 km/h (10 mph)or more below the set speed during crusing.
32	ON OFF BE3933	• Short in control switch circuit.
34	ON OFF BE3933	• Voltage abnormality in control switch circuit.
41	ON OFF BE4345	• When 41 code is indicated, replace the cruise control ECU.

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Fig. 21 Cruise control diagnostic codes

Components

➧ See Figure 22

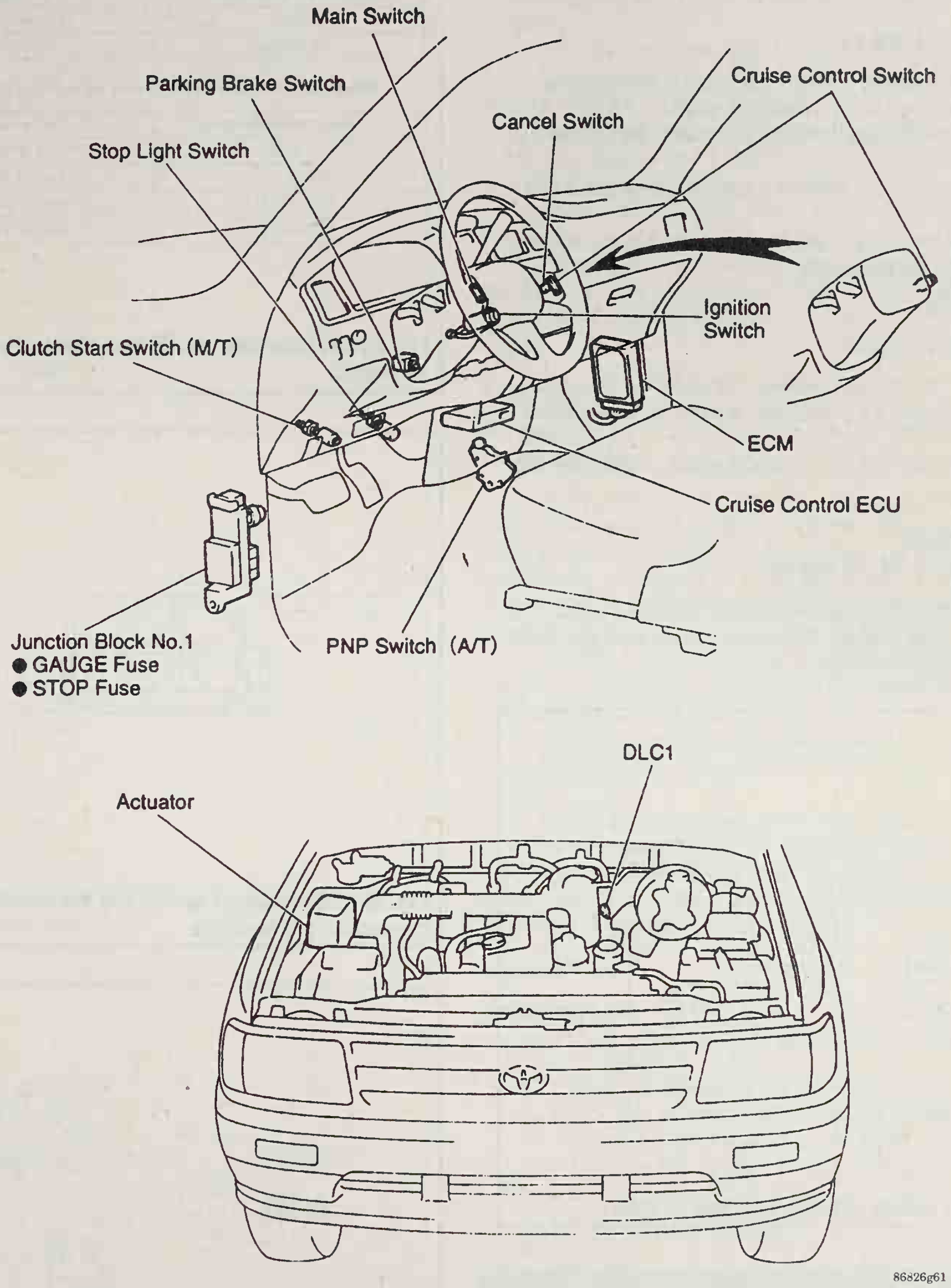

Main Switch
Parking Brake Switch
Cruise Control Switch
Cancel Switch
Stop Light Switch
Ignition Switch
Clutch Start Switch (M/T)
ECM
Cruise Control ECU
Junction Block No.1
● GAUGE Fuse
● STOP Fuse
PNP Switch (A/T)
DLC1
Actuator
86826g61

Fig. 22 Common cruise control component locations — T100 shown

TESTING

Cruise Control Main Switch

T100

➧ See Figures 23 and 24

1. Unplug the switch connector. It may be necessary to remove the steering column covers for access.
2. Check for continuity between terminals 3 and 5 with the switch both on and off.
3. Next, measure the resistance between terminals 3 and 4.
4. If the switch did not perform as indicated in the illustration, replace the control switch.

LAND CRUISER

➧ See Figures 24 and 25

1. Inspect the continuity between the terminals 3 and 5.
2. Next, measure the resistance between terminals 3 and 4.
3. If the resistance is not to specifications, replace the control switch.

Stop Light Switch

➧ See Figures 26, 27, 28 and 29

The stop light switch is located behind the brake pedal. Inspect the continuity of the the various pin connections. Refer to the illustrations.

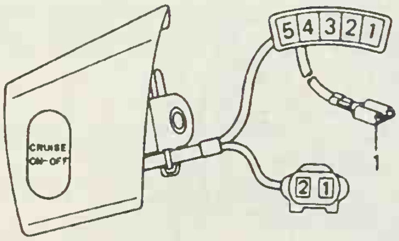


Fig. 23 Main switch terminal locations — T100

Check continuity between terminals 3 and 5.

Control Switch Position	Condition
OFF	No continuity
ON (pushed)	Continuity

Measure resistance between terminals 3 and 4.

Control Switch Position	Resistance Ω
OFF	∞ (No continuity)
RES / ACC	Approx. 68 Ω
SET / COAST	Approx. 198 Ω
CANCEL	Approx. 418 Ω

86826g51

Fig. 24 Test the main switch as indicated in the illustration

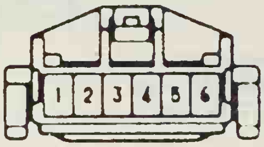


Fig. 25 Cruise control switch and the terminal connection pin locations

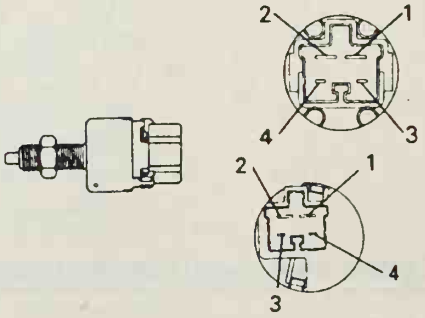


Fig. 26 Stop light switch and the terminal connection pin locations — Land Cruiser

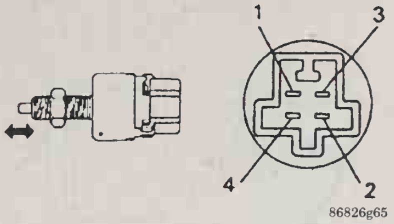


Fig. 27 Stop light switch and the terminal connection pin locations — T100

Switch position	Tester connection	Specified condition
Switch pin free (Brake pedal depressed)	1 – 2	Continuity
Switch pin pushed in (Brake pedal released)	3 – 4	Continuity

86826g54

Fig. 28 On Land Cruiser, check for continuity between the terminals indicated

Switch position	Tester connection	Specified condition
Switch pin free (Brake pedal depressed)	2 – 4	Continuity
Switch pin pushed in (Brake pedal released)	1 – 3	Continuity

86826g66

Fig. 29 On T100, test the switch as indicated in the illustration

Vehicle Speed Sensor

LAND CRUISER

➧ See Figure 30

The vehicle speed sensor is located in the back of the transmission.

1. Remove the vehicle speed sensor from the vehicle.
2. Connect the positive lead from the battery to terminal 1 and the negative lead to terminal 2.
3. Connect the positive lead from the voltmeter to terminal 3 and the negative lead to terminal 2.
4. Revolve the shaft.
5. Check that there is a voltage change between terminals 3 and 2.
6. The voltage change should be 4 times per each revolution of the vehicle speed sensor shaft. If the operation is not as specified, replace the sensor.

T100

➧ See Figures 31 and 32

➠Testing is performed from the back of the combination meter assembly.

1. Unplug connector C from the combination meter, then inspect the connector on the wire harness side.
2. Is there continuity between terminal C10 and ground? If not, there is an open circuit in the wire harness between terminal C10 of the combination meter and ground or there is a ground fault.
3. Engage connector A of the combination meter. Unplug the connector from the cruise control ECM, then inspect the connector on the wire harness side.
4. If there is continuity repeatedly between terminal 20 and ground, replace the cruise control ECM, then recheck the system.
5. If there is no continuity, there is an open or short circuit in the wire harness between terminals 20 of the cruise ECM and C10 of the combination meter. Or, there is an open or short in the circuit plate of the combination meter between terminal C10 and the speed sensor.

Actuator

LAND CRUISER

➧ See Figures 33, 34, 35 and 36

1. To check the actuator magnetic clutch:
    a. Check that the arm moves smoothly by hand.
    b. Attach the positive lead from the battery to terminal 5 and negative lead to terminal 4. Have the magnetic clutch turned on.
    c. Check that the arm does not move by hand at this point.

⁂WARNING

Do not connect the wires to the wrong battery terminals. You will damage your cruise control actuator.

2. If the operation is not as specified in the test, replace the actuator motor.

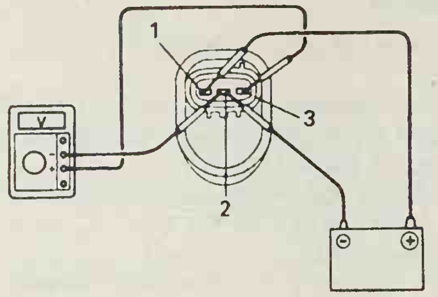

V
1
2
3
86826g53

Fig. 30 Connect the voltmeter and battery as shown to test the speed sensor

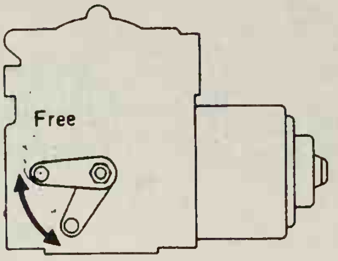

Free
86826g55

Fig. 33 Check to see that the actuator arm moves freely

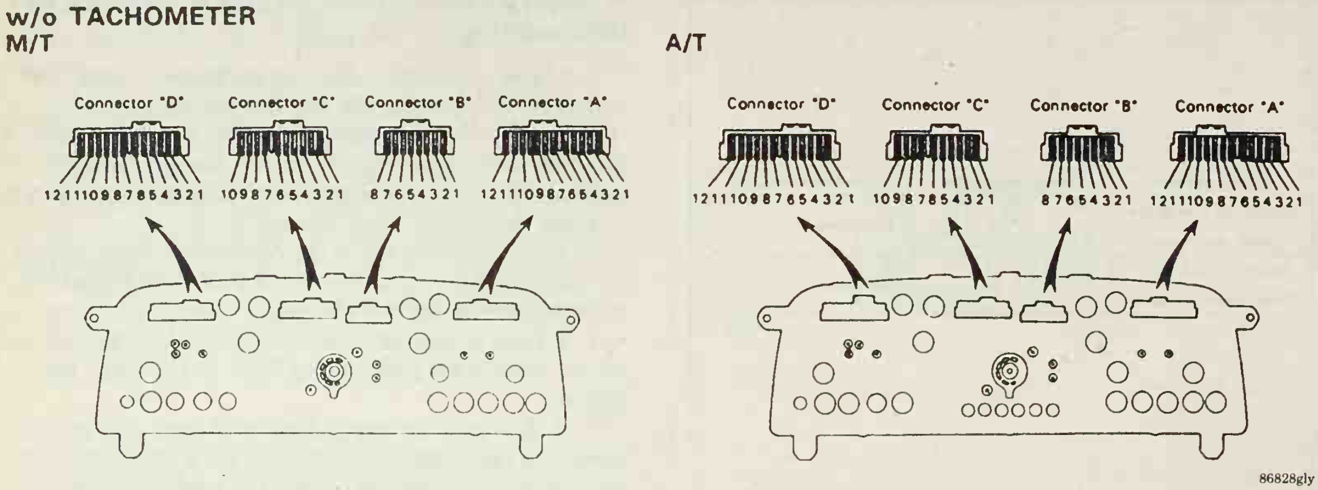

w/o TACHOMETER
M/T
Connector "D"
Connector "C"
Connector "B"
Connector "A"
12 11 10 9 8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
8 7 6 5 4 3 2 1
12 11 10 9 8 7 6 5 4 3 2 1
A/T
Connector "D"
Connector "C"
Connector "B"
Connector "A"
12 11 10 9 8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
8 7 6 5 4 3 2 1
12 11 10 9 8 7 6 5 4 3 2 1
86828gly

Fig. 31 Terminal locations on the T100 without a tachometer

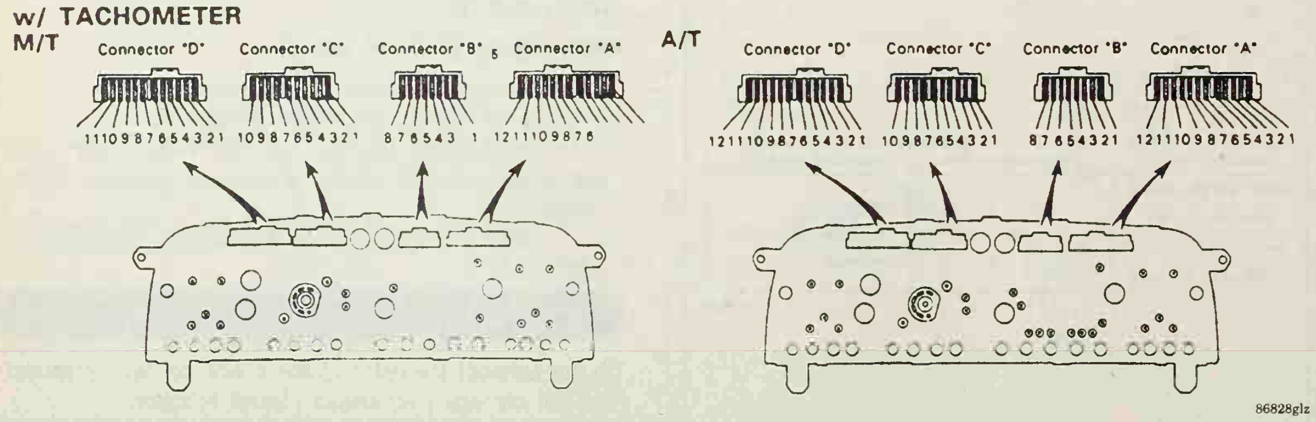

w/ TACHOMETER
M/T
Connector "D"
Connector "C"
Connector "B"
Connector "A"
11 10 9 8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
8 7 6 5 4 3 1
12 11 10 9 8 7 6
A/T
Connector "D"
Connector "C"
Connector "B"
Connector "A"
12 11 10 9 8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
8 7 6 5 4 3 2 1
12 11 10 9 8 7 6 5 4 3 2 1
86828glz

Fig. 32 Terminal locations on the T100 with a tachometer

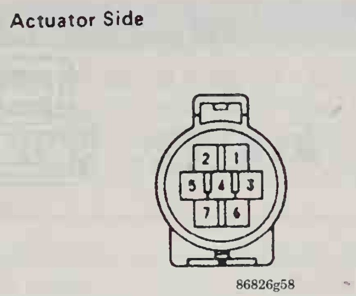


Fig. 34 Actuator terminal identification

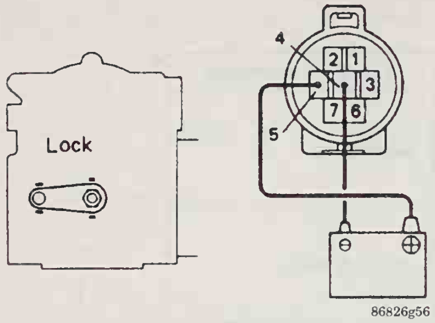


Fig. 35 With power applied as shown, the arm should be locked

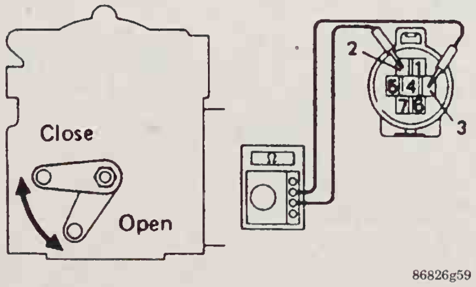


Fig. 36 When the arm is moving from the closed to the open position, check the resistance between terminals 2 and 3

3. To check the operation of the motor:
   a. With the magnetic clutch on, connect the positive lead from the battery to terminal 6, then attach the negative lead to terminal 7. Check that the arm moves to the open side.
   b. When the arm reached to the open position, check that the motor operation stops.
   c. While the magnetic clutch is on, attach the positive lead from the battery terminal 7 and the negative lead to terminal 6. Check that the arm moves to the close side.
   d. While the arm reaches the closed position, check to see if the motor operation stops.
4. To inspect the position sensor:
   a. Measure the resistance between terminals 1 and 3 of the connection. Resistance should read approximately 2k ohms.
   b. When the arm is moving from the closed to the open position, check to see the resistance between terminals 2 and 3 increases from approximately 500-700 ohms.

T100

➧ **See Figure 37**

1. To check the actuator magnetic clutch:
   a. Check that the arm moves smoothly by hand.
   b. Attach the positive lead from the battery to terminal 5 and negative lead to terminal 4. Have the magnetic clutch turned on. Check that the arm does not move by hand.

✳✳CAUTION

Do not connect the high tension cables to the wrong battery terminals. You will damage your cruise control actuator.

2. If the operation is not as specified in the test, replace the actuator motor.
3. To check the operation of the motor:
   a. With the magnetic clutch on, connect the positive lead from the battery to terminal 6, then attach the negative lead to terminal 7. Check that the arm moves to the open side.
   b. When the arm reached to the open position, check that the motor operation stops.

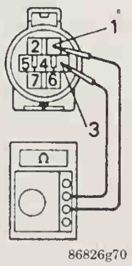


Fig. 37 Measure the resistance between terminals 1 and 3

c. While the magnetic clutch is on, attach the positive lead from the battery terminal 7 and the negative lead to terminal 6. Check that the arm moves to the close side.

d. While the arm reaches the closed position, check to see if the motor operation stops.

4. To inspect the position sensor:

a. Measure the resistance between terminals 1 and 3 of the connection. Resistance should read approximately 2k ohms.

b. When the arm is moving from the closed to the open position, check to see the resistance between terminals 2 and 3 increases from approximately 500-800 ohms.

Clutch Start Switch

➧ See Figures 38 and 39

1. Remove the switch from the vehicle.
2. Check the continuity of the switch as indicated in the illustration.
3. If the switch does not operate as indicated, replace the switch.

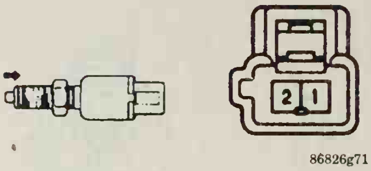
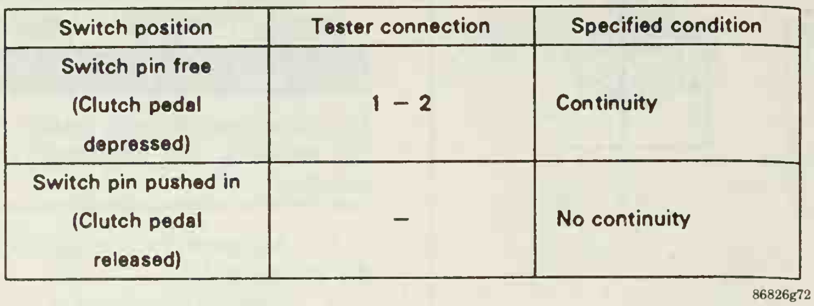


Fig. 38 Connect an ohmmeter between the two terminals to check for continuity



Switch position	Tester connection	Specified condition
Switch pin free (Clutch pedal depressed)	1 — 2	Continuity
Switch pin pushed in (Clutch pedal released)	—	No continuity

Fig. 39 Check that the switch operates as indicated

ENTERTAINMENT SYSTEMS

➧ **See Figure 40**

⁂WARNING

Never operate the radio without a speaker; severe damage to the output transistors will result. If the speaker must be replaced, use a speaker of the correct impedance (ohms) or the output transistors will be damaged and require replacement.

Some audio systems have an anti-theft system built into them. The system requires the operator to select and program a 3-digit code into the unit. If no code is installed, the anti-theft system is inoperative; the audio unit functions as a normal unit, even after power is restored after disconnection. Complete instructions for installing the code are found in the owners manual for the vehicle. As long as power remains connected to the unit, it may be used in the normal fashion. Once power is disconnected from the unit, the audio unit will not function until the correct code is re-entered. This will render the unit useless if stolen; there is no way to retrieve the stored code.

The anti-theft code may be canceled or changed following an exact procedure explained in the vehicles owners manual. If an error is made during the procedure, the designation ERR appears in the digital window. Once 10 errors have occurred, the word HELP appears and the system will not work regardless of codes or power. If the HELP message appears, the unit must be taken to a Toyota dealer to be reset.

All of the units equipped with this system have the words ANTI THEFT SYSTEM visible on the front of the unit, usually on the tape player door. Care must be taken when working on these vehicles anytime the battery cable must be disconnected or if fuses are removed during other test procedures. If its your vehicle, chances are good that you know the code (if one was installed); if its a friends vehicle, you could be in trouble. Always check with the owner before beginning any work which

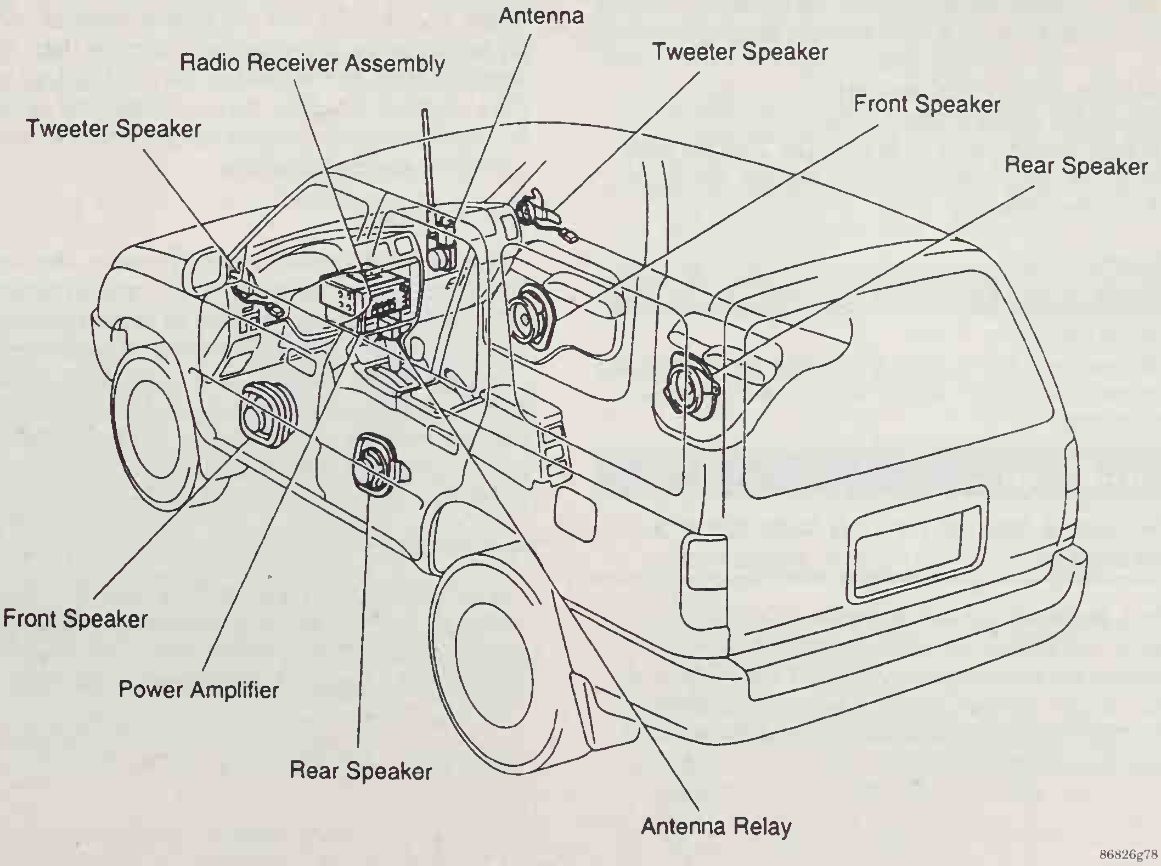


Fig. 40 Common radio system component locations — 1996 4Runner shown

could interrupt power to the audio unit. For any further information on your particular unit, see your owners manual.

Radio

REMOVAL & INSTALLATION

Excluding Land Cruiser

1. If audio unit carries the designation ANTI THEFT SYSTEM, make certain you or the vehicle owner knows the security code. If the code is not re-entered after installation, the unit will not operate.
2. On some models you may need to remove the heater control assembly, Following the procedures given earlier in this section.
3. Remove the bolts holding the audio unit to the dash. Pull the unit out of the lower dash enough to allow access to the rear and sides.
4. Unplug the antenna cable and wiring connectors. Remove the radio with its bracket.

To install:

5. Fit the audio unit and bracket loosely in place; connect the antenna and wiring connectors.
6. Work the unit gently into position. Be careful not to pinch any wires or lines under or around the unit. Install the retaining screws.
7. Install the heater control assembly.
8. Connect the negative battery cable.
9. Turn the ignition switch to **ACC** or **ON**. Turn the radio on and enter the security code if one is required. Check the system for correct operation.

Land Cruiser

1. Disconnect the negative battery cable. Remove the ashtray. Remove the ashtray holder.
2. Remove the 3 screws holding the lower instrument panel trim. The trim panel is also held by six clips; each must be gently pried loose.

****WARNING**

The trim panel is long and thin; it is easily broken by rough handling.

3. Once the panel is loose, unplug the wiring connectors to the switches and remove the panel from the area.
4. Remove the screws holding the audio unit to the dash.
5. Pull the unit outward enough to allow access to the sides and back. Unplug the antenna cable and the electrical connectors. Remove the radio unit.

To install:

6. Loosely fit the unit into place and engage the antenna and electrical connections.
7. Fit the unit into the dash and install the retaining screws.
8. Hold the large dash panel in place and engage the wiring connectors to each switch.
9. Install the trim by aligning all the clips at once and gently pushing each into place. Install the retaining screws.
10. Install the ashtray holder and ashtray.
11. Connect the negative battery cable.
12. Turn the ignition switch to **ACC** or **ON**. Turn the radio on and enter the security code if one is required. Check the system for correct operation.

Speakers

REMOVAL & INSTALLATION

➡Always disconnect the negative battery cable before attempting to remove the speakers.

Dash Mounted

Dash mounted speakers can be accessed after removing the appropriate trim panel. These panels are usually retained by screws and clips. Be sure you have removed all of the attaching screws before prying the panel from the dash. Do not use excessive force on the panel as this will only lead to damage. Once the panel has been removed, loosen the speaker attaching bolts/screws, then pull the speaker from the dash and unplug the electrical connection.

Door Mounted

Door mounted speakers can be accessed after removing the door panel. These panels are usually retained by screws and clips. Be sure you have removed all of the attaching screws before prying the panel from the door. A special tool can be purchased for this purpose. Do not use excessive force on the panel as this will only lead to damage. Once the panel has been removed, loosen the speaker attaching bolts/screws, then pull the speaker from its mount and unplug the electrical connection.

Rear Speakers

Removing the rear speakers involves basically the same procedure as the front speakers. Remove the appropriate trim panel, then remove the speaker. The rear speakers on some models can be accessed from inside the rear hatch.

WINDSHIELD WIPERS AND WASHERS

Windshield Wiper Blade

REMOVAL & INSTALLATION

➡Wiper blade element replacement is covered in Section 1.

Toyota has two types of wiper blades. The screw-on type and the clip-on type.

To remove the clip-on type, lift up the wiper arm from the windshield. Lift up on the spring release tab on the wiper blade-to-wiper arm connector, then pull the blade assembly off the wiper arm.

To remove the screw-on type, lift up the wiper arm from the windshield. Loosen and remove the two screws retaining the blade to the arm, then lift the blade assembly off the wiper arm.

Windshield Wiper Arm

REMOVAL & INSTALLATION

➧ See Figures 41 and 42

1. There may be a cover over the nut, remove this to access the nut. With the arm in the down position, unscrew the nut which secures it to the pivot. Carefully pull the arm upward and off the pivot.

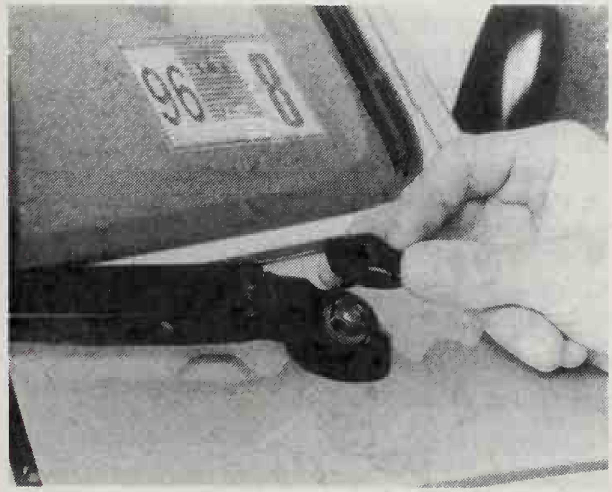

86826p10

Fig. 41 Remove the cover concealing the nut

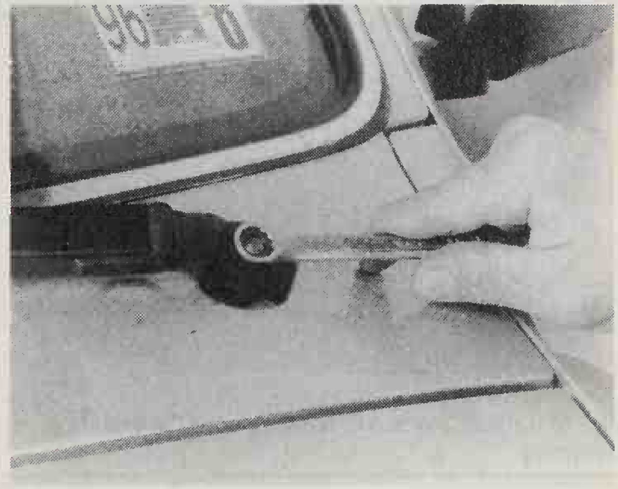

86826p11

Fig. 42 Loosen and remove the retaining nut

To install:

2. Install the arm by placing the arm onto the linkage shaft. Make sure it is seated correctly; if not correctly aligned, the blade will slap the bodywork at the top or bottom of its stroke. Tighten the nut to approximately 15 ft. lbs. (20 Nm).

➡If one wiper arm does not move when turned on or only moves a little bit, check the retaining nut at the bottom of the arm. The extra effort of moving snow or wet leaves off the glass can cause the nut to come loose — the pivot will move without moving the arm.

Windshield Wiper Motor

REMOVAL & INSTALLATION

➧ See Figures 43, 44, 45 and 46

The wiper motor is located in the engine compartment and is secured to the firewall.

1. Disconnect the wiring from the wiper motor and unbolt it from the firewall.
2. Gently pry the wiper link from the crank arm. Its a ball and socket arrangement, but it may be tight.
3. Remove the motor.

To install:

4. Connect the wiper arm linkage. The socket must be exactly aligned with the ball before snapping them together.
5. Install the motor, tighten the mounting nuts to 47 inch lbs. (6 Nm).
6. Attach the electrical lead.

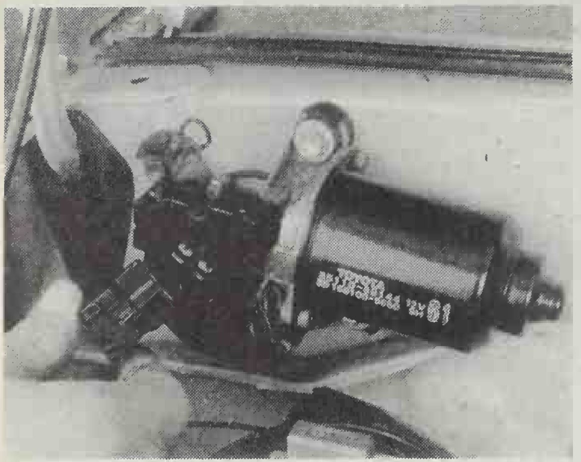


Fig. 43 Unplug the wiring harness from the motor assembly

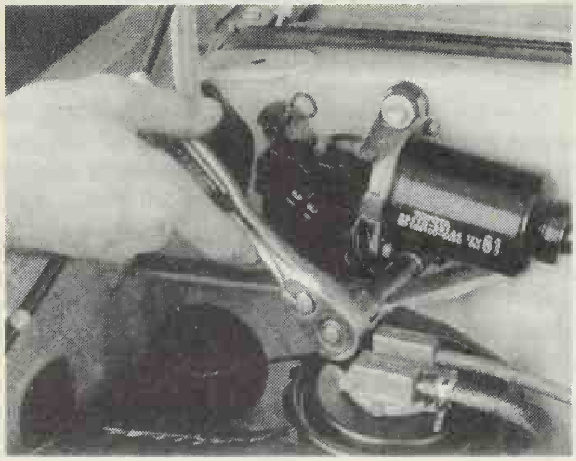


Fig. 44 Remove the bolts securing the wiper motor from the firewall

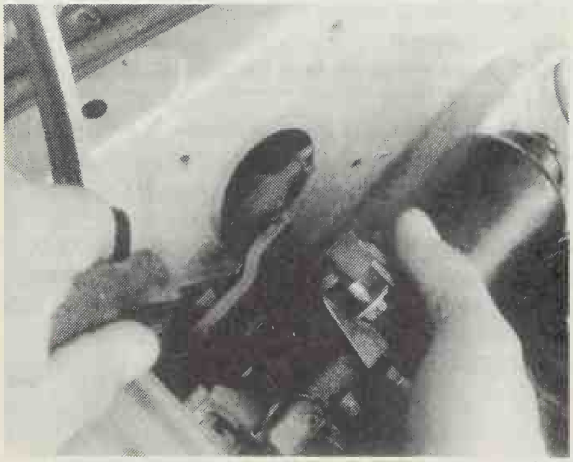


Fig. 45 Pull the motor from the firewall, then using a prybar . . .

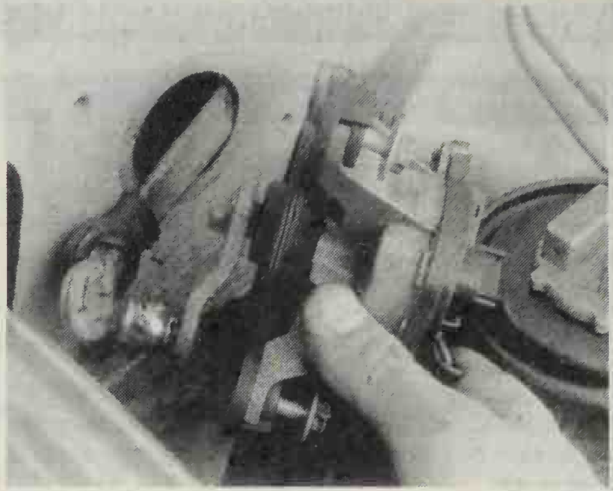


Fig. 46 . . . separate the linkage from the motor

Rear Wiper Motor

REMOVAL & INSTALLATION

4Runner

TOP MOUNTED

➧ See Figure 47

1. Make certain the ignition switch is **OFF**.
2. Pop up the acorn nut cover, remove the nut and pull off the rear wiper.
3. Remove the pivot nut.
4. Inside, above the tailgate, pop out the clips and remove the wiper motor cover.
5. Disconnect the electrical lead and the washer hose, remove the mounting bolts and lift out the wiper motor.

To install:

6. Position the wiper motor and install the mounting bolts.
7. Connect the lead and the washer hose.
8. Position the wiper motor cover over the opening and press in the retaining clips.
9. Install the pivot nut and tighten it to 8 ft. lbs. (11 Nm).
10. Install the wiper arm and tighten the acorn nut to 48 inch lbs. Snap the cover down.

BOTTOM MOUNTED

➧ See Figures 48 and 49

1. Remove the back door trim, plate and door glass run.
2. Separate the weatherstrip from the door, then remove the rear glass.
3. Remove the rear wiper arm.
4. Disconnect the wiring harness from the motor.
5. Remove the nut securing the packing holder.
6. Loosen the wiper motor seat bolts, then the motor assembly.
7. Remove the washer nozzle.

To install:

8. Install the washer nozzle.

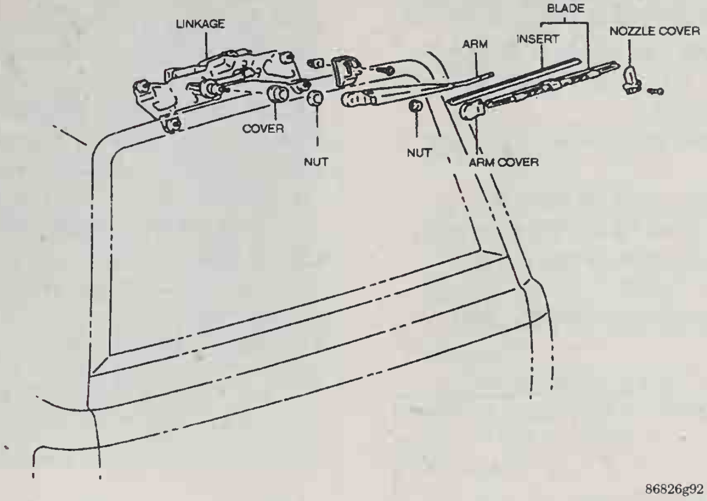

LINKAGE
BLADE
INSERT
ARM
NOZZLE COVER
COVER
NUT
NUT
ARM COVER
86826g92

Fig. 47 Top mounted rear wiper system

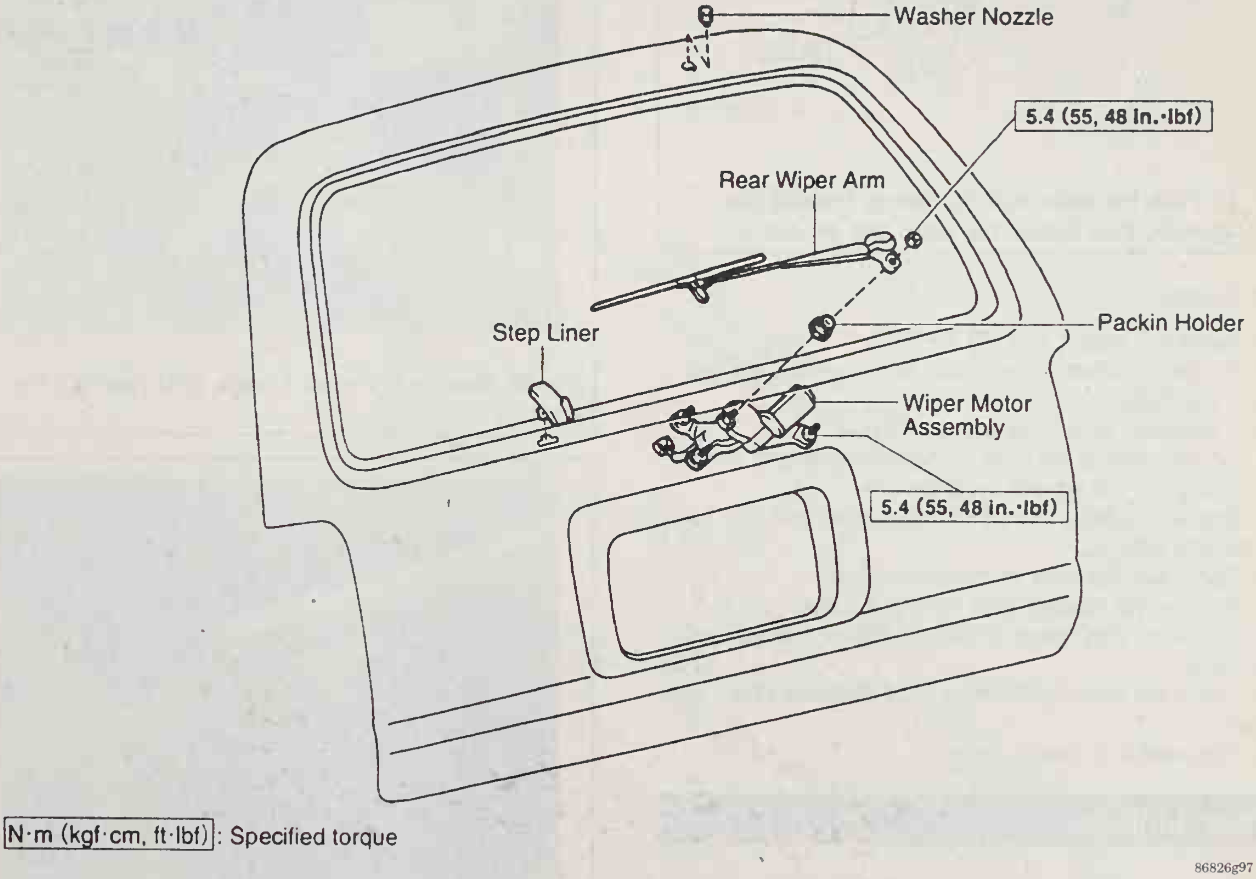
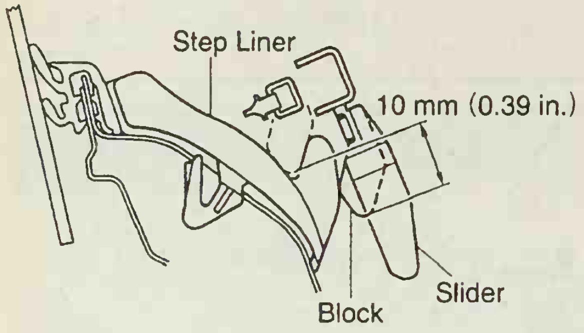

Washer Nozzle
5.4 (55, 48 in.·lbf)
Rear Wiper Arm
Step Liner
Packin Holder
Wiper Motor Assembly
5.4 (55, 48 in.·lbf)
N·m (kgf·cm, ft·lbf): Specified torque
86826g97

Fig. 48 Bottom mounted rear wiper system

9. Tighten the wiper motor bolts, then install the motor assembly. Tighten the motor bolts to 48 inch lbs. (5 Nm).
10. Install the packing holder and nut, tighten to 48 inch lbs. (5 Nm).
11. Attach the harness to the motor.
12. Install the wiper arm and operate the wiper once, then turn the wiper switch off.
13. When tightening the rear arm, push the slider 0.39 in. (10mm) towards the turning slide, then tighten the wiper arm set nut with the step liner on the block as shown in the illustration. Tighten to 48 inch lbs. (5 Nm).
14. Install the back door glass, outer weatherstrip, glass run, plate and door trim.



86828gmz

Fig. 49 Push the slider 0.39 in. (10mm) towards the turning slide, then tighten the wiper arm set nut

Land Cruiser

1. Insure the ignition switch is **OFF**.
2. On some models you will need to remove the pull handle and pull handle bezel.
3. If presents, remove the backdoor trim.
4. Lift the cover at the base of the rear wiper arm, remove the retaining nut and remove the wiper arm.
5. Remove the large nut on the wiper motor axle (the part that the arm bolts to).
6. Disconnect the wiper motor wire harness.
7. Remove the retaining bolts holding the motor and remove the motor. Don't bend or damage nearby linkages or components.
8. Unbolt the wiper control relay, then disconnect the harness.
9. Reassemble in reverse order.

Wiper Linkage

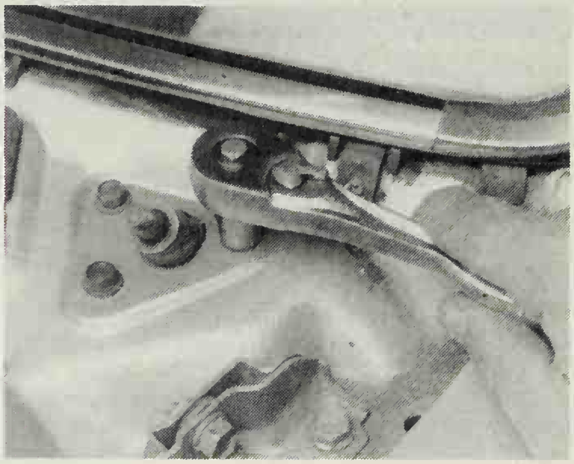
REMOVAL & INSTALLATION

See Figures 50, 51, 52 and 53

1. Remove the wiper motor.
2. Separate the wiper arms by removing their retaining nuts and working them off their shafts.
3. Remove the nuts/bolts and spacers holding the wiper shafts.
4. Unclamp the grilles that cover the linkage, then push the shafts down into the body cavity. Pull the linkage out of the cavity through the wiper motor hole.

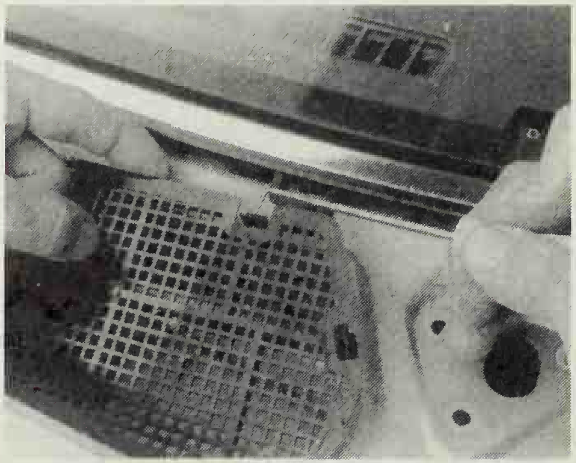
To install:

5. Insert the wiper linkage through the hole and install the nuts and spacers.
6. Press the wiper arm onto their shafts and install the retaining nuts.
7. Install the wiper motor.



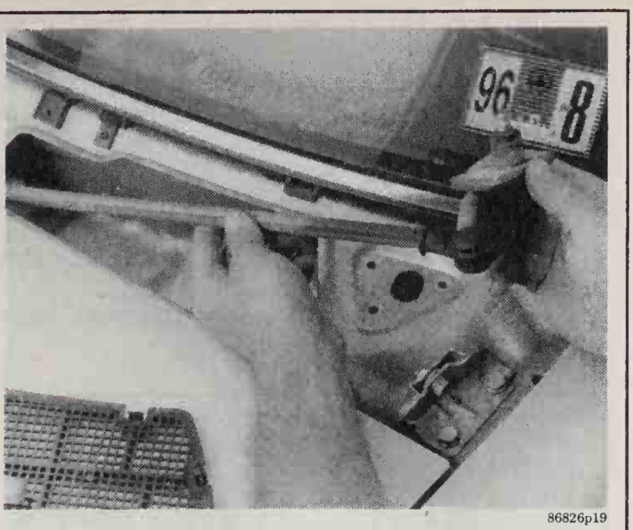
86826p17

Fig. 50 Remove the wiper linkage bolts retaining the ends



86826p18

Fig. 51 Unclamp the grilles to lift the linkage up and out



86826p19

Fig. 52 Slide the linkage through the hole in the cowl

Washer Fluid Reservoir

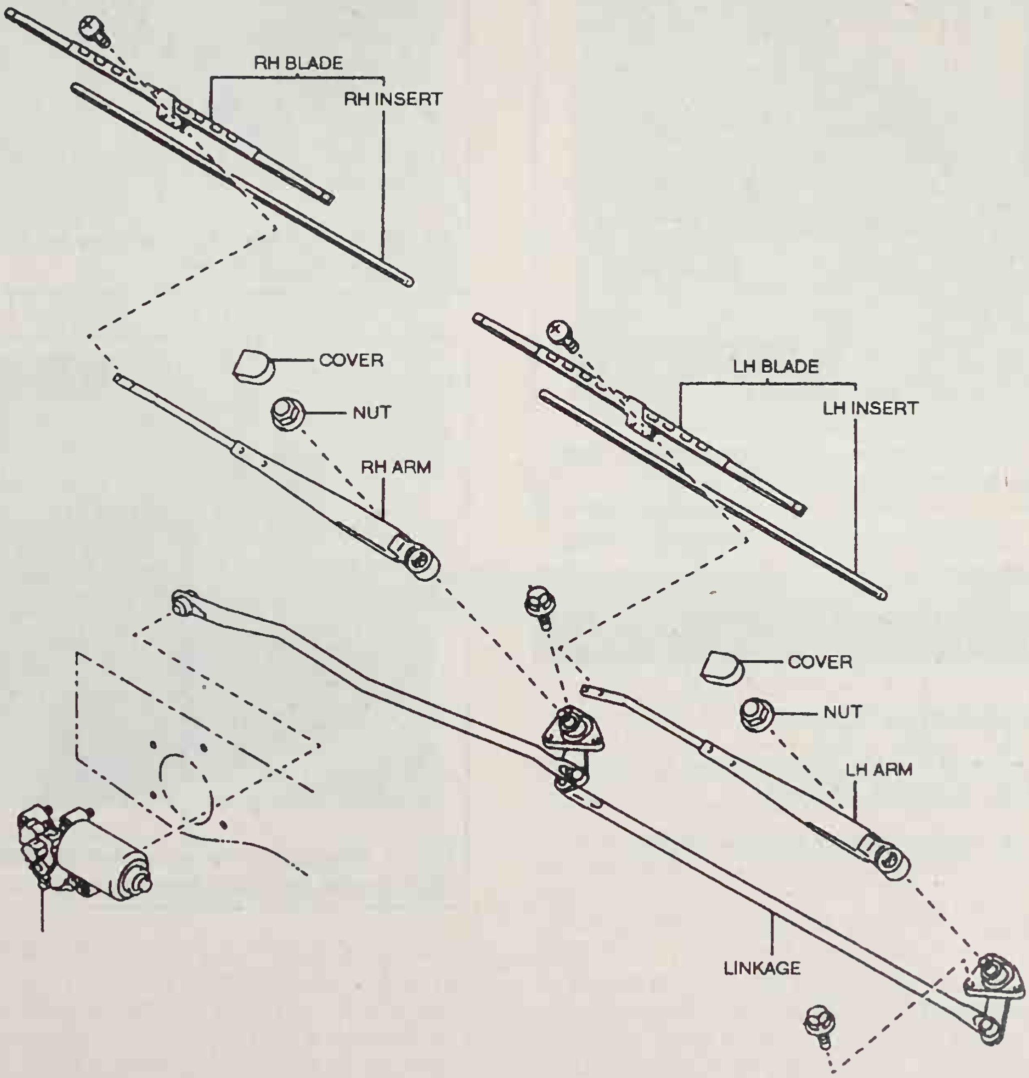
REMOVAL & INSTALLATION

See Figures 54 and 55

1. Unbolt the washer reservoir from the upper radiator support.
2. Lift the unit from the engine compartment, then slide the hose from the unit.
3. Unhook the wiring harness for the pump from the side of the reservoir.
4. Disconnect the wiring harness from the pump, then remove the pump from the reservoir. Check the condition of the grommet that the pump sits into.

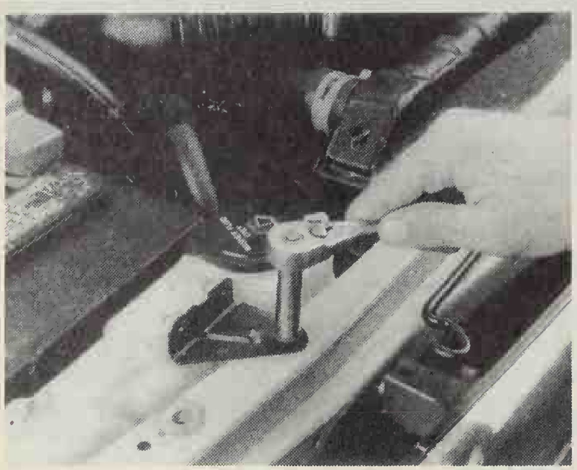
To install:

5. Install the pump into the reservoir, ensure the grommet is in good condition.
6. Attach the wiring to the pump, then run the hose for the pump along the side of the reservoir.



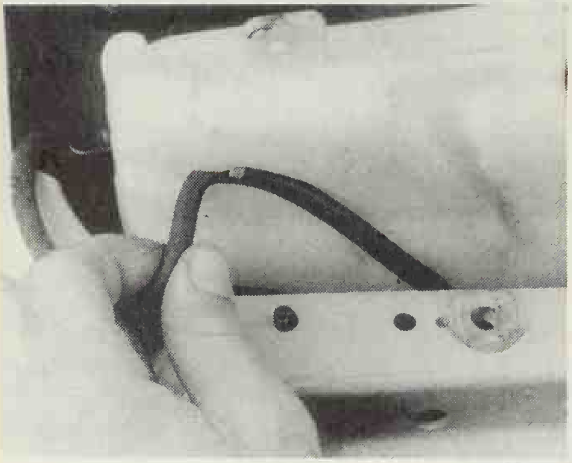
86826g91

Fig. 53 Exploded view of the front wiper linkage



86826p20

Fig. 54 Unbolt the reservoir bracket from the upper radiator support



86826p21

Fig. 55 Lift the unit from the engine compartment, then slide the hose from the unit

7. Seat the reservoir into the engine compartment, secure with the mounting bolt.

Washer Pump

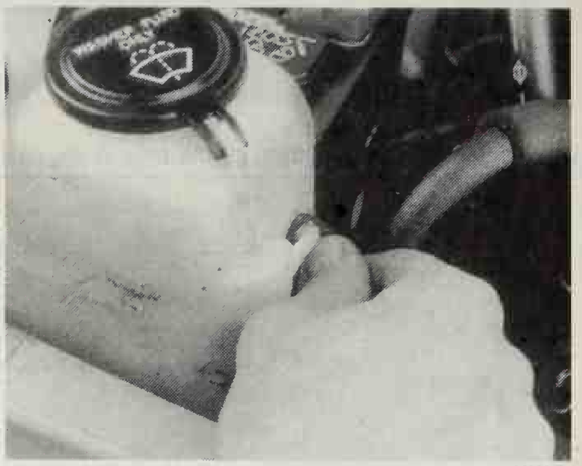
REMOVAL & INSTALLATION

See Figures 56, 57, 58, 59, 60 and 61

1. Remove the washer reservoir from the vehicle.
2. Unhook the wiring harness for the pump from the side of the reservoir.
3. Disconnect the wiring harness form the pump, then remove the pump from the reservoir. Check the condition of the grommet that the pump sits into.

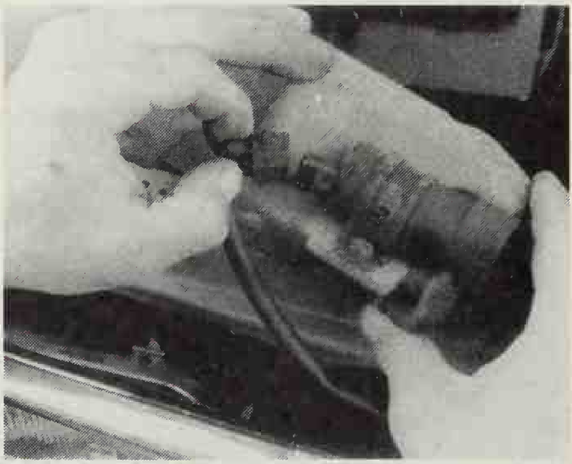
To install:

4. Install the pump into the reservoir, ensure the grommet is in good condition.
5. Attach the wiring to the pump, then run the hose for the pump along the side of the reservoir.
6. Seat the reservoir into the engine compartment. Secure with the mounting bolt.



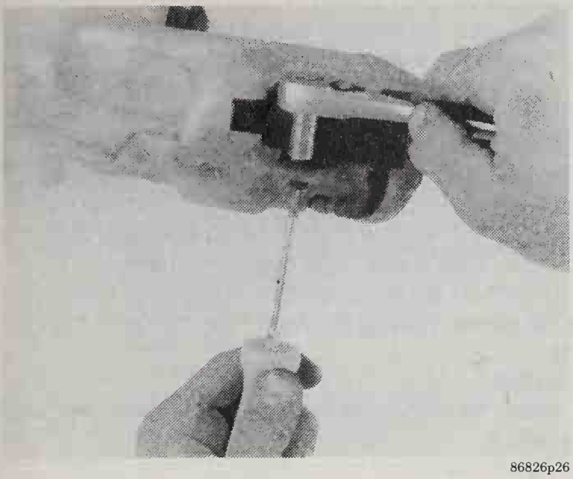
86826p22

Fig. 56 Unhook the wiring harness for the pump from the side of the reservoir



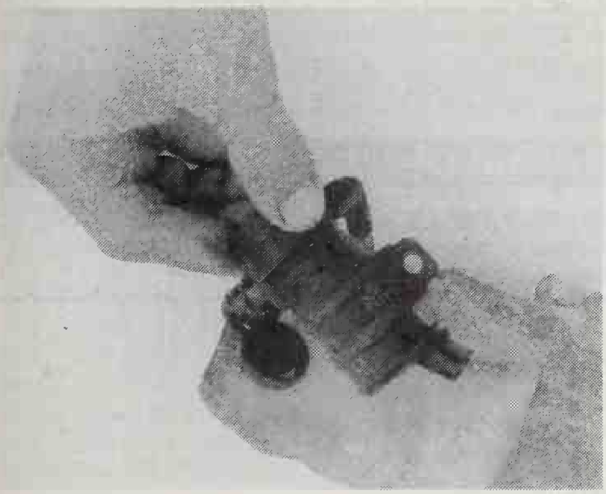
86826p23

Fig. 57 Disconnect the wiring harness form the pump, then remove the pump from the reservoir



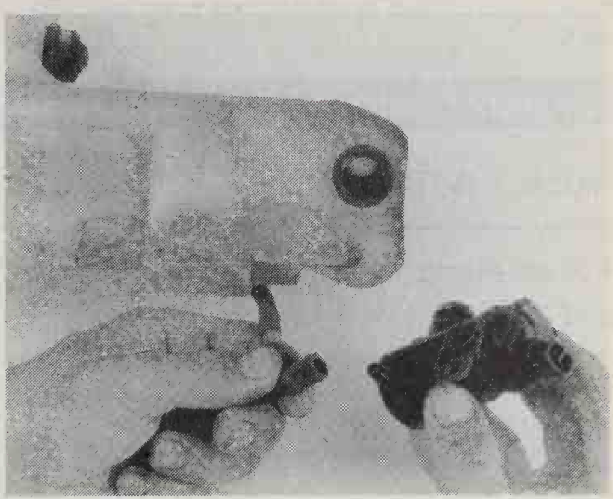
86826p26

Fig. 58 Remove the bolts retaining the pump to the reservoir



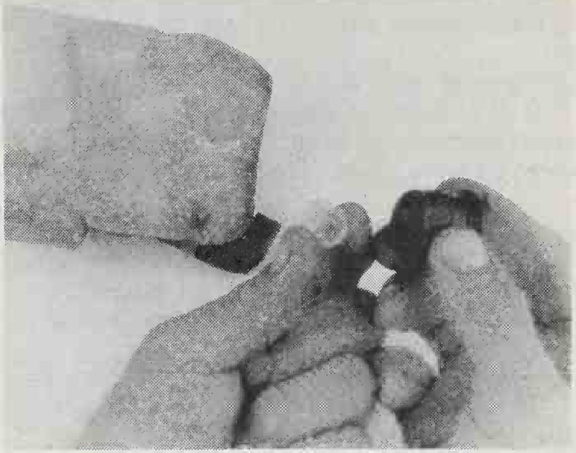
86826p27

Fig. 59 Pull the pump from the grommet



86826p28

Fig. 60 Remove the hose from the pump



86826p29

Fig. 61 Remove the grommet and screen, then inspect for deterioration

INSTRUMENTS AND SWITCHES

To keep our terms straight, we'll use Toyotas names for various dash components. The instrument panel is what you may call the dashboard; it runs completely across the front of the vehicle. The instrument panel is covered with a soft vinyl surface called the safety pad. The safety pad is the part you see; the instrument panel is the framework under it. All the instruments and warning lamps in front of the driver are contained in the combination meter, sometimes called the gauge set or instrument cluster. The combination meter is removed as a unit.

Generally, numbered components use a numbering system with item 1 on the left side of the vehicle. Knowing how many numbered components there are can be helpful, too. For example, if heater ducts Nos. 1, 2 and 3, must be removed, its a fair bet that No. 2 is in the center. If the procedure only refers to Nos. 1 and 2, one may be on the left side and 2 on the right of the passenger compartment.

When disassembling components, always suspect the hidden screw or clip. Much of the fit and finish in the interior is accomplished by using concealed retainers to keep panels in place. Don't force anything during removal; if any resistance is felt, search out the hidden connector. Some of the panels assemble only in the correct order; pay attention. Take note of which bolts and screws go into each retainer; a too-long bolt can damage wiring or components behind the assembly being held.

Finally, understand that this is a lengthy project. Work slowly and carefully so as not to damage anything. Label or mark each electrical connector as it is disconnected; many of the plastic connector shells can be marked with an indelible laundry pen or similar marker. As a panel or component is removed, disconnect the wiring running to switches or components held by the panel. Be careful working around wires and harnesses; most are held by retainers and do not allow a lot of slack.

Instrument Cluster

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Disconnect the negative battery cable.
2. Remove the steering wheel.
3. Remove the upper and lower steering column covers.
4. Remove the hood release lever from the panel. Its held by two screws.
5. Separate the cowl side trim on each side. You might refer to it as the kick panel.
6. Remove the lower center instrument panel cover.
7. Remove the ignition key cylinder cover.
8. Detach the No. 1 lower finish panel; this is the panel holding the left speaker and running under the steering column.
9. Remove the heater duct to No. 2 outlet.
10. Pull off the heater control knobs, remove the A/C switch if equipped and gently pry up on the heater control unit to remove it. The prying tool should have a taped or protected edge.
11. For all models except Pick-Ups with 4 speed manual transmissions, remove the 3 screws holding the meter trim. Pull the trim or surround panel outward and disconnect the connectors. On 4Runner, remove the two screws and the cup holder from the panel.
12. For Pick-Ups with 4 speed manual transmissions, the trim is held only by two screws. Disconnect the connectors and remove the trim panel.
13. Remove the No.1 air outlet. Its held by 2 screws.
14. Remove the four screws holding the combination meter. Work it out of the panel until access is gained to the rear. Disconnect the speedometer cable and remove the electrical connectors. Remove the meter assembly, placing it in a safe location out of the work area.

To install:

15. Install the lower center instrument panel cover.
16. Install the cowl side trim (kick panels).
17. Attach the hood release and bracket.
18. Install the steering column covers.
19. Install the steering wheel.
20. Connect the negative battery cable.
21. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

1996 MODELS

⁂CAUTION

Your vehicle may contain an air bag system. Read the procedure in this section of how to disarm the system before proceeding.

1. Disable the SRS system.
2. Disconnect the negative battery cable.
3. Remove the steering wheel.
4. Remove the cowl side trim and the front door scuff plate.
5. Remove the retainers securing the lower finish panel, then remove the hood and fuel tank release lever screws.
6. Remove the ignition switch bezel.
7. Detach the No. 2 and No. 1 heater-to-register duct.
8. Remove the cluster finish panel, then remove.
9. Disconnect the harness for the combination meter. Remove the screws securing the meter, then remove it from the vehicle.

To install:

10. Attach the harness to the combination meter, then attach to the vehicle.
11. Tighten the cluster finish panel.
12. Attach the No. 2 and No. 1 heater-to-register duct.
13. Install the ignition switch bezel.
14. Install the lower finish panel, then attach the hood and fuel tank release lever.
15. Install the cowl side trim and the front door scuff plate.
16. Install the steering wheel.
17. Connect the negative battery cable.

Tacoma

⁂CAUTION

Your vehicle may contain an air bag system. Read the procedure in this section of how to disarm the system before proceeding.

1. Disable the SRS system.
2. Disconnect the negative battery cable.
3. Remove the steering wheel.
4. Remove the following:
   a. Steering column cover
   b. Hood lock release lever
   c. Combination switch
   d. Fuse box cover
5. Remove the lower left hand finish panel.
6. Remove the following parts:
   a. Ignition switch bezel
   b. No. 2 heater-to-register
   c. Steering column
7. Remove the cup holder and the heater control knobs.
8. With the aid of a flat-bladded tool, remove the heater control panel.
9. Disconnect the hazard harness.
10. Remove the mounting screws for the center cluster finish panel.
11. Detach the heater control assembly.
12. Remove the radio.
13. Remove the screws mounting the cluster finish panel, then lower the panel.
14. Remove the combination meter screws and the speedometer cable.
15. Disconnect the harness.

To install:

16. Attach the harness to the combination meter.

17. Install the speedometer cable, then the combination meter.
18. Install the cluster finish panel.
19. Install the radio.
20. Place the heater control assembly in the dash.
21. Reinstall the mounting screws for the center cluster finish panel and tighten.
22. Install the harness for the hazard switch.
23. Place the heater control panel in the dash.
24. Install the cup holder and the heater control knobs.
25. Reattach the following parts:
    a. Ignition switch bezel
    b. No. 2 heater-to-register
    c. Steering column
26. Tighten the lower left hand finish panel.
27. Install the following:
    a. Steering column cover
    b. Hood lock release lever
    c. Combination switch
    d. Fuse box cover
28. Install the steering wheel, then connect the negative battery cable.

T100

⁂CAUTION

Your vehicle may contain an air bag system. Read the procedure in this section of how to disarm the system before proceeding.

1. Disable the SRS system.
2. Disconnect the negative battery cable.
3. Remove the front pillar garnish.
4. Unscrew the front door scuff plate and the cowl side trims.
5. Remove the steering wheel.
6. Remove the following:
    a. Steering column cover
    b. Disconnect the hood lock release lever
    c. Detach the No. 1 lower finish panel
    d. Remove the combination switch
    e. Remove the glove box door
    f. Detach the No. 2 lower finish panel
    g. Remove the lower center panel
7. Remove the screws retaining the center cluster finish panel, then detach the harness from the unit.
8. Remove the stereo opening cover.
9. Remove the screws securing the meter, then remove the combination meter from the dash.

To install:

10. Tighten the combination meter into place.
11. Attach the stereo opening cover.
12. Attach the cluster harness, then install and tighten the screws that retain the center cluster finish panel.
13. Install the following:
    a. Steering column cover
    b. Install the hood lock release lever
    c. Attach the No. 1 lower finish panel
    d. Install the combination switch
    e. Install the glove box door
    f. Install the No. 2 lower finish panel
    g. Install the lower center panel
14. Install the steering wheel.
15. Attach, then tighten the front door scuff plate and the cowl side trims.
16. Place the front pillar garnish into position and tighten the screws.
17. Connect the negative battery cable.

Land Cruiser

1989-90 MODELS

1. Disconnect the negative battery cable.
2. Remove the steering wheel.
3. Remove the Nos. 2 and 3 air ducts. These are above the drivers knees under the dash.
4. Disconnect the throttle cable from the accelerator pedal and retainer. Remove the cable set nut and remove the cable.
5. Remove the hood release lever and the fuel lid opener lever.
6. Remove the heater control lever knobs. Remove the ash tray.
7. Remove the five screws and two clips holding the center instrument finish panel. Remove the panel and disconnect the wiring harnesses.
8. Remove the seven screws holding the instrument cluster trim panel. Loosen the panel, disconnect the wiring and unhook the speedometer cable.
9. Remove the radio.
10. Remove the glove box door. Remove the courtesy switch and light.
11. Remove the four screws holding the glove box; remove the latch striker and remove the glove box.
12. Remove the mounting bolt holding the EFI computer; pull it out gently and disconnect the wire harness. Place the computer in a very safe location out of the work area.
13. Remove air ducts Nos. 1, 3 and 4; each is held by a single screw.
14. At the side defrosters, remove only the lower screw and disconnect the defroster hose.
15. Remove the four screws and four nuts holding the safety pad. Loosen two clips and remove the pad.
16. Remove the heater control panel.
17. Disconnect the electrical connectors at the mirror control switch, the dimmer and 4WD control.
18. Remove the fuse box; its held by two screws.
19. Remove the two upper side mounting bolts holding the steering column.
20. The instrument panel is held by 15 bolts. Once the bolts are removed, move the panel towards the rear of the vehicle to remove it. Once removed, the various components still on the panel may be removed if desired.

To install:

21. Assemble the instrument panel with any items removed. Fit the panel into place, connect the wiring and secure the retaining bolts. Make certain the panel is flush and level. The heater vent ducts must match up exactly with no leaks. Make any needed adjustments now.
22. Install the upper side mounting bolts holding the steering column.
23. Install the fuse box and cover.
24. Connect the mirror control switch, the dimmer and the 4WD switch connectors.

25. Connect the cables and install the heater controls.
26. Install the safety pad, making sure the clips are properly seated and that the piece is aligns perfectly.
27. Connect the side defroster hoses to the grilles and install the lower screws.
28. Attach the Nos. 1, 3, and 4 air ducts.
29. Connect the harness to the EFI computer and install the unit. Make sure the harness is connected squarely and firmly.
30. Install the glove box and striker. Connect the switch and light and install the glove box door.
31. Install the radio.
32. Place the instrument finish panel in place. Connect the speedometer cable and the electrical harnesses. Install the panel and the retaining screws.
33. Install the center lower trim panel, connecting the wiring as needed. Install the ash tray and install the heater control knobs.
34. Install the hood release and fuel door levers.
35. Connect the throttle cable to the accelerator pedal.
36. Attach the Nos. 2 and 3 air ducts.
37. Install the steering column covers.
38. Install the steering wheel.
39. Connect the negative battery cable.
40. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

1991-95 MODELS

⁂CAUTION

Your vehicle may contain an air bag system. Read the procedure in this section of how to disarm the system before proceeding.

1. Disable the SRS system.
2. Disconnect the negative battery cable.
3. Remove the steering wheel.
4. Apply strips of protective tape on the inside of each windshield pillar. This will protect the trim during removal.
5. Remove the upper and lower steering column covers.
6. Remove the hood release and fuel door release levers.
7. Unscrew the lower trim panel below the steering column.
8. Remove the heater duct running to the left dash outlet (No. 2). The duct is the one under the dash, above the drivers knees.
9. Remove the combination switch from the steering column. The combination switch is the lighting control/turn signal/wiper control assembly.
10. Remove the turn signal bracket from the steering column; its the piece just below the combination switch.
11. Remove the ashtray and remove the ashtray holder.
12. Remove the three screws holding the lower instrument panel trim. The trim panel is held by six clips which must be released to remove the panel.
13. Remove the instrument cluster trim; it is held by six screws and two clips.
14. Remove the four screws holding the combination meter and gently loosen it; disconnect the electrical harnesses and unhook the speedometer cable. Place the instrument cluster in a safe location out of the work area.

To install:

15. Place the combination meter in position. Connect the speedometer cable and attach the wiring connectors. Make sure the electrical connectors are squarely and firmly seated. Install the meter unit.
16. Install the cluster trim panel. Make sure the clips are in place.
17. Install the lower center trim panel. All six clips must be correctly seated. Install the retaining screws.
18. Install the ashtray holder and the ashtray.
19. Install the turn signal bracket and the combination switch.
20. Connect the heater duct to air outlet No. 2.
21. Install the lower trim panel and the 4 screws.
22. Attach the hood and fuel door levers.
23. Install the steering column covers. Install the steering wheel.
24. Remove the protective tape from the windshield pillars.
25. Connect the negative battery cable.
26. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

1996 MODELS

⁂CAUTION

Your vehicle may contain an air bag system. Read the procedure in this section of how to disarm the system before proceeding.

1. Disable the SRS system.
2. Disconnect the negative battery cable.
3. Remove the steering wheel.
4. Apply strips of protective tape on the inside of each windshield pillar. This will protect the trim during removal.
5. Remove the upper and lower steering column covers.
6. Remove the hood release and fuel door release levers.
7. Remove the fuse box opening cover.
8. Remove the retaining screws for the lower trim panel below the steering column.
9. Remove the lower instrument panel.
10. Disconnect the No. 2 heater-to-register duct.
11. Loosen the screws and remove the fuse block.
12. Detach the No. 2 center cluster finish panel.
13. Remove the steering column.
14. Detach the cluster finish panel, then the combination meter.
15. Remove the center cluster finish panel assembly with the clock attached.
16. With the aid of a taped prytool, take off the 2 claws, then remove the cup holder hole cover.
17. Remove the ashtray.
18. Remove the center cluster finish panel with the heater control assembly, then disconnect the harness.
19. Remove the screws retaining the heater control assembly from the center cluster finish panel.
20. Remove the following:
    a. Radio
    b. Glove compartment door
    c. Speaker panel
    d. Speaker

   e. Front console box
   f. Rear console box

21. Loosen and remove the 5 screws and 9 bolts holding the instrument panel.

22. Remove the lower instrument panel reinforcement, then the No. 1 brace and the instrument panel.

To install:

23. Attach the No. 1 brace and lower instrument panel, then the instrument panel reinforcement.

24. Tighten the 5 screws and 9 bolts holding the instrument panel.

25. Install the following:
   a. Radio
   b. Glove compartment door
   c. Speaker panel
   d. Speaker
   e. Front console box
   f. Rear console box

26. Tighten the screws retaining the heater control assembly to the center cluster finish panel.

27. Connect the harness to the heater control, then attach the center cluster finish panel with the heater control assembly.

28. Reinstall the ashtray.

29. Place the cup holder hole cover into position.

30. Install the center cluster finish panel assembly with the clock attached.

31. Install the combination meter.

32. Attach the cluster finish panel.

33. Install the steering column.

34. Attach the No. 2 center cluster finish panel.

35. Install the fuse block.

36. Insert and attach the No. 2 heater-to-register duct.

37. Install and tighten down the lower instrument panel.

38. Place the lower trim panel below the steering column, then tighten.

39. Attach the fuse box opening cover.

40. Place into position, then tighten down the hood release and fuel door release levers.

41. Attach the upper and lower steering column covers.

42. Install the steering wheel.

43. Connect the negative battery cable.

Speedometer, Tachometer and Gauges

REMOVAL & INSTALLATION

➧ See Figure 62

1. Remove the gauge cluster from the dashboard.
2. Remove the lens covering the gauges.
3. Remove the printed circuit board from the back of the cluster. This can be done by removing any attaching screws and by removing the bulbs from the unit.
4. Remove the gauge attaching screws.
5. Installation is the reverse of removal.

Combination Switch

REMOVAL & INSTALLATION

➧ See Figures 63, 64 and 65

The individual switches within the combination switch are individually replaceable after the combination assembly is removed and disassembled. It is not difficult but is exacting, requiring careful removal of wire terminals from the multi-pin connector.

1. Insure the ignition is switched **OFF**.
2. Remove the steering wheel pad and remove the steering wheel. Use of a steering wheel puller is strongly recommended. Always scribe matchmarks on the wheel hub and the steering column so the wheel can be reinstalled straight.
3. Remove the upper and lower steering covers. Remove the retaining screws holding the combination switch to the column.
4. Trace the harness down the column, then unplug the connector. Release the harness from the harness clamp(s).
5. Remove the combination switch from the column and place it on the workbench.
6. Disconnect the air bag harness (if equipped).
7. On the newer models, you will be able to remove the two mounting screws retaining the arm (wiper ect.) to replace.
8. Otherwise, identify the component to be replaced. Identify each wire color running from the switch (to be replaced) to the connector. These wires (only) will need to be removed so the new ones can be installed.
9. On all but 1989-90 Land Cruiser, the cover on the back of the connector must be raised to allow the wire terminal to be removed.
10. Diagram each wire and terminal to be removed. The new wiring must be installed exactly as original. From the front or plug end, insert a small pick or probe between the locking lug and the wire terminal. Pry down the locking lug with the tool and pull the terminal out from the rear. Repeat the procedure for each wire from the switch to be replaced.
11. With the wires free, remove the retaining screws holding the switch to be changed and remove it. The lighting control stalk has a spring and small ball with it; don't lose them.

To install:

12. Assemble the new component(s) onto the switch. Retaining screws should be tight enough to hold but not over tight. Components with cracked plastic won't stay in place.
13. Track the new wires into the harness and place each wire loosely in its correct terminal socket.
14. Use the removal tool to push on the back of the terminal (NOT on the wire) and force the terminal into the connector. Each terminal must be pushed in until it overrides the locking lug. Test each one by gently pulling the wire backwards; it should be positively locked in place.
15. Fit the combination switch assembly onto the steering column and install the retaining screws. Install the upper and lower steering column covers.
16. Install the wire harness into the clips and retainers; connect the connectors.
17. Align the matchmarks and reinstall the steering wheel and pad.

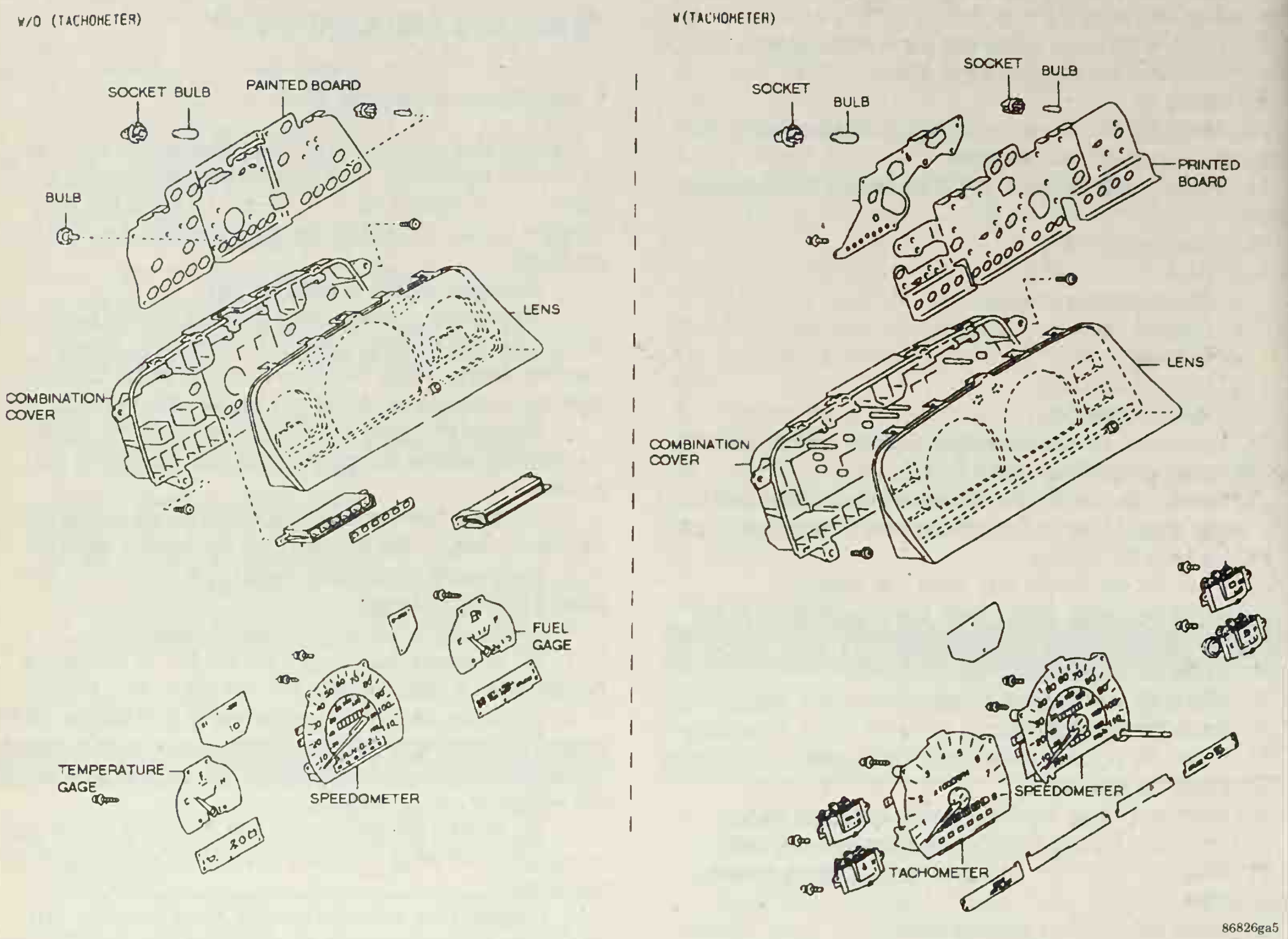

W/O (TACHOMETER)
SOCKET
BULB
PAINTED BOARD
BULB
LENS
COMBINATION COVER
FUEL GAGE
TEMPERATURE GAGE
SPEEDOMETER
W(TACHOMETER)
SOCKET
BULB
SOCKET
BULB
PRINTED BOARD
LENS
COMBINATION COVER
SPEEDOMETER
TACHOMETER
86826ga5

Fig. 62 Exploded view of the instrument cluster assembly

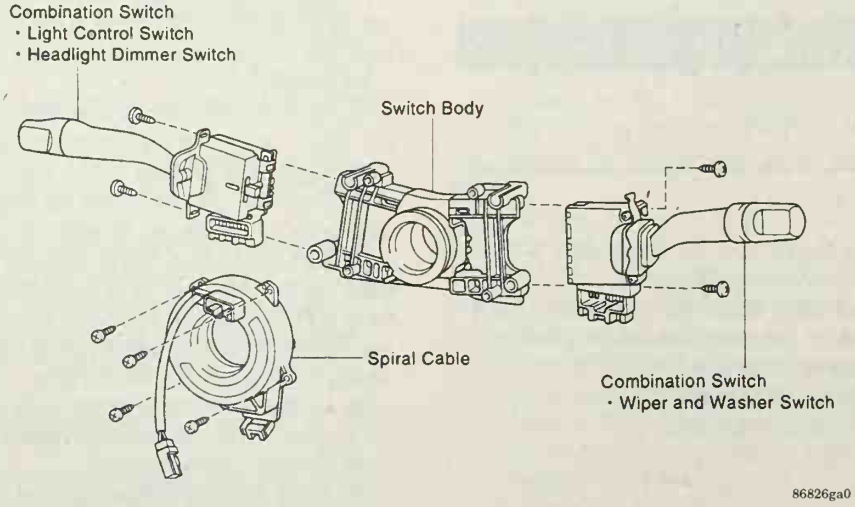

Combination Switch
• Light Control Switch
• Headlight Dimmer Switch
Switch Body
Spiral Cable
Combination Switch
• Wiper and Washer Switch
86826ga0

Fig. 63 The switches are secured to the switch body with screws

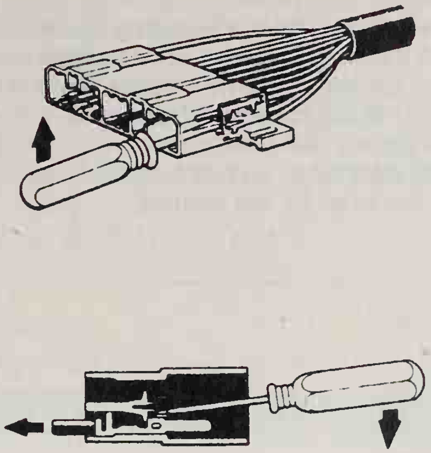


Fig. 64 From the front or plug end, insert a small pick or probe between the locking lug and the wire terminal

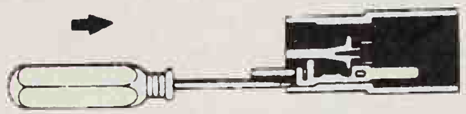


Fig. 65 Each terminal must be pushed in until it overrides the locking lug

18. Turn the ignition switch **ON** and check the function of each control item.

Clock

REMOVAL & INSTALLATION

The clock is part of the radio. If the clock is found to be defective the radio will have to be removed and sent to an authorized facility for clock repair.

Speedometer Cable

REMOVAL & INSTALLATION

➧ **See Figures 66 and 67**

The speedometer cable connects a rotating gear within the transmission to the dashboard speedometer/odometer assembly. The dashboard unit interprets the number of turns the made by the cable and displays the information as miles per hour and total mileage.

Assuming that the transmission contains the correct gear for the vehicle, the accuracy of the speedometer depends primarily on tire condition and tire diameter. Badly worn tires (too small in diameter) or over-inflation (too large in diameter) can affect the speedometer reading. Replacement tires of the incorrect overall diameter (such as oversize snow tires) can also affect the readings.

Generally, manufacturers state that speedometer/odometer error of plus or minus 10% is considered normal due to wear and other variables. Stated another way, if you drove the truck over a measured 1 mile course and the odometer showed anything between 0.9 and 1.1 miles, the error is considered normal. If you plan to do any checking, always use a measured course such as mileposts on an Interstate highway or turnpike. Never use another truck for comparison; the other trucks inherent error may further cloud your readings.

The speedometer cable can become dry or develop a kink within its case. As it turns, the ticking or light knocking noise it makes can easily lead an owner to chase engine related problems in error. If such a noise is heard, carefully watch the speedometer needle during the speed range in which the noise is heard. Generally, the needle will jump or deflect each time the cable binds. The needle motion may be very small and hard to notice; a helper in the back seat should look over the drivers shoulder at the speedometer while the driver concentrates on driving.

➡The slightest bind in the speedometer cable can cause unpredictable behavior in the cruise control system. If the cruise control exhibits intermittent surging or loss of set speed symptoms, check the speedometer cable first.

Some cables do not attach directly to the speedometer assembly but rather to an electrical pulse generator. These pulses may be used for the meter and mileage signal. Additionally, the electric signals representing the speed of the truck can be used by the fuel injection control unit, the cruise control unit and other components.

1. Remove the instrument cluster and disconnect the cable at the speedometer. On some models it may be possible to disconnect the cable by reaching under the dash. Some connectors screw onto the back of the speedometer; others are held by plastic clips.
2. Disconnect the other end of the speedometer cable at the transmission extension housing and pull the cable from its jacket at the transmission end. If you are replacing the cable because it is broken, don't forget to remove both pieces of broken cable.

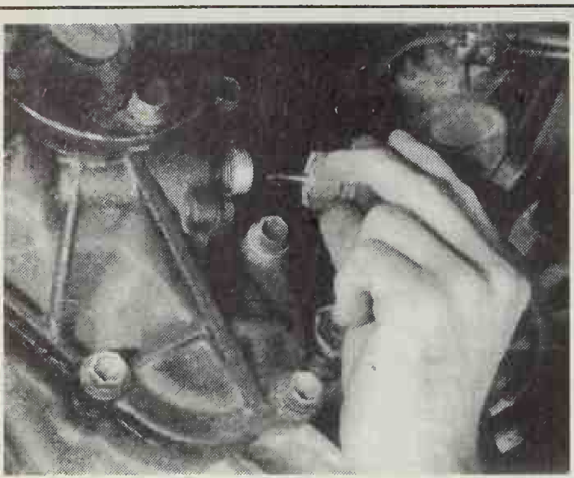
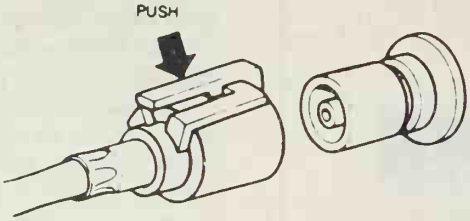

86826p25

Fig. 66 Unscrew the cable at the transmission to remove

To install:

3. Lubricate the new cable with graphite speedometer cable lubricant, and feed it into the cable jacket from the lower end.
4. Connect the cable to the transmission, then to the speedometer. Note that both ends of the cable are square; the ends must fit properly in the fittings.
5. Plug the electrical connector into the instrument cluster, and replace the cluster if it was removed.



86826gb3

Fig. 67 The plastic retainer must be pushed down to release the speedometer cable on most models

LIGHTING

Headlights

Headlights, like any other lighting device, can fail due to broken filaments. The front of any truck is the worst possible location for a lighting device since it is subject to impact, extensive temperature change and severe vibration — all of which shorten the life of the light. The front of the truck is also where good lighting is needed the most so its not uncommon to have to replace a headlight during the life of the vehicle.

There are two general styles of headlamps, the sealed beam and replaceable bulb type. The sealed beam is by far the most common and includes almost all of the circular and rectangular lamps found on vehicles built through the 1980s. The sealed beam is so named because it includes the lamp (filament), the reflector and the lens in one sealed unit. Sealed beams are available in several sizes and shapes.

The replaceable bulb is the newer technology. Using a small halogen bulb, only the lamp is replaced, while the lens and reflector are part of the body of the car. This is generally the style found on wrap-around or "European" lighting systems. While the replaceable bulbs are more expensive than sealed beams, they generally produce more and better light. The fixed lenses and reflectors can be engineered to allow better frontal styling and better light distribution for a particular vehicle.

It is quite possible to replace a headlight of either type without affecting the alignment (aim) of the light. Sealed beams mount into a bracket (bucket) to which springs are attached. The adjusting screws control the position of the bucket which in turn aims the light. Replaceable bulbs simply fit into the back of the reflector. The lens and reflector unit are aimed by separate adjusting screws.

Take a moment before disassembly to identify the large adjusting screws (generally two for each lamp, one above and one at the side) and don't change their settings.

With the exception of the oldest vehicles, sealed beams are removed from the outside of the car. Start with the outer trim pieces and work your way in to the lamp and its retainer. Bulb type units are almost always replaced from under the hood.

REMOVAL & INSTALLATION

Sealed Beams

➧ See Figures 68, 69, 70, 71 and 72

⁂CAUTION

Most headlight retaining rings and trim bezels have very sharp edges. Wear gloves. Never pry or push on a headlamp; it can shatter suddenly.

1. Make sure the headlight switch is in the off position.
2. Loosen the parking and side turn signal unit retaining screws. Then remove the units unplugging the connectors.
3. Next, open the hood to gain access to the grille clips. Using a flat-bladded tool, push on the clips to release them and the grille.
4. The sealed beam is held in place by a retainer and either 2 or 4 small screws. Identify these screws before applying any tools. DO NOT confuse the small retaining screws with the larger aiming screws. There will be two aiming screws or adjustors for each lamp. (One adjustor controls the up/down motion and the other controls the left/right motion.) Identify the adjustors and avoid them during removal. If they are not disturbed, the new headlamp will be in identical aim to the old one.
5. Using a small screwdriver (preferably magnetic) and a pair of taper-nose pliers if necessary, remove the small screws in the headlamp retainer. DON'T drop the screws; they vanish into unknown locations.

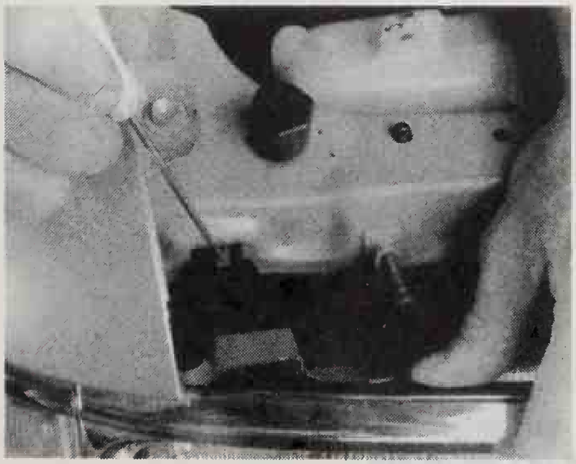

86826p88

Fig. 68 After removing the parking lamp screws, push on the grille clips to release the grille from the truck

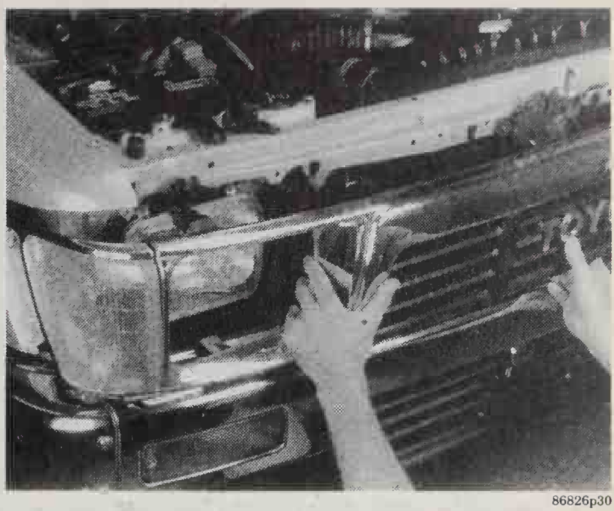

86826p30

Fig. 69 Remove the grille from the truck and set aside

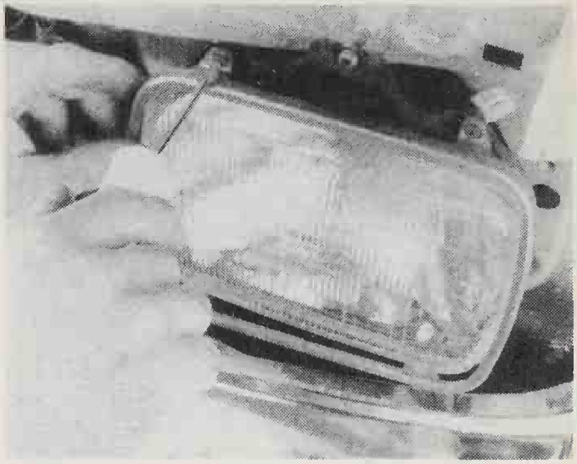

86826p31

Fig. 70 Remove the headlight bezel which is secured by screws

➡A good kitchen or household magnet placed on the shank of the screwdriver will provide enough grip to hold the screw during removal.

6. Remove the retainer and the headlamp may be gently pulled free from its mounts. Detach the connector from the back of the sealed beam unit and remove the unit from the car.

⁂CAUTION

The retainers can have very sharp edges. Wear gloves.

To install:

7. Place the new headlamp in position and connect the wiring harness. Remember to install the rubber boot on the back of the new lamp; its a water seal. Make sure the headlight is right-side up.

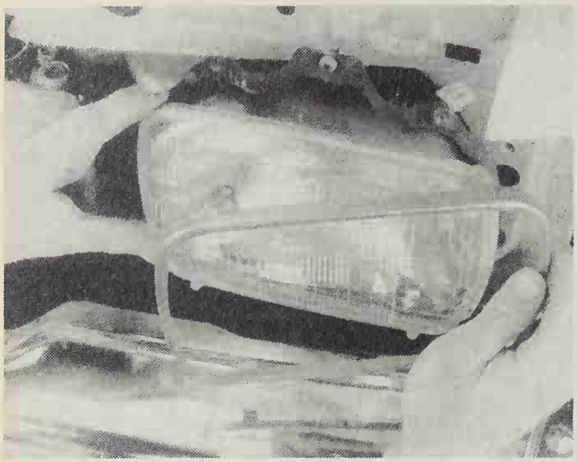


Fig. 71 **Be careful when removing the headlight bezels, they can be sharp**

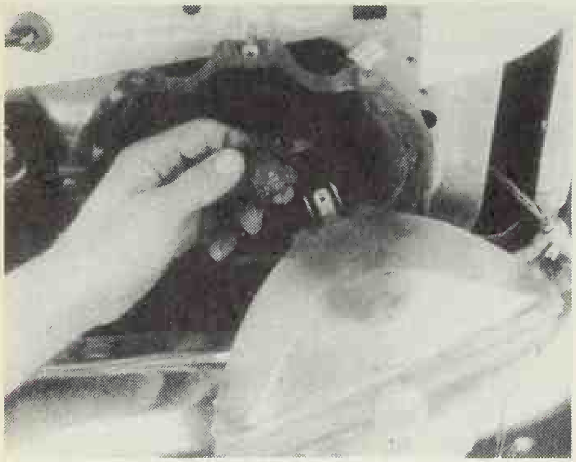


Fig. 72 **Pull the light out, then unplug the wiring harness from behind it**

8. Have an assistant turn on the headlights and check the new lamp for proper function, checking both high and low beams before final assembly.
9. Install the retainer and the small screws that hold it.
10. Reinstall the headlight bezel and/or grille.

European Headlamps

RETAINING RING TYPE

➧ See Figures 73 and 74

1. With the ignition switch **OFF** and the headlamp switch OFF, raise and prop the hood.
2. On Pick-Ups and 4Runners, remove the grille and headlamp assembly.
3. On Land Cruisers:
   a. If the right headlamp is to be changed, lift out the coolant reserve tank. Place the tank in an out of the way location but NOT on the battery or engine. Don't spill any coolant.
   b. If the left headlamp is to be changed:
   c. Remove the air duct (3 bolts).
   d. Remove the air suction silencer and the air switching valve. Label the hoses so they go back in the correct places.
   e. Remove the underhood cooling fan. Its held by 3 bolts; don't forget to disconnect the electrical harness.

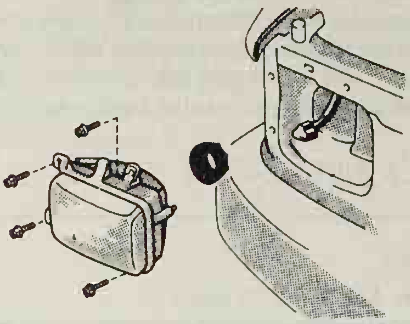


Fig. 73 **Remove the headlamp, then unplug the connector**

4. Unplug the connector from the back of the lamp. The connector may be very tight and require wiggling to loosen; support the lamp while with your other hand while wiggling the connector loose.
5. Turn the bulb socket about 45° counterclockwise to loosen it. Remove the bulb.

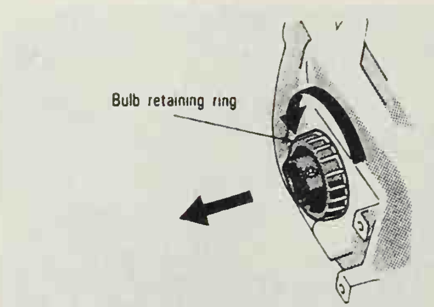


Fig. 74 **Turn the bulb retaining ring counterclockwise, then take out the bulb**

To install:

6. Install the new bulb with the socket pointing up. Make certain all three guide tabs fit into their correct slots. Turn the socket clockwise to lock it in place.

⁂WARNING

Hold the new bulb by the base; do NOT touch the glass part with fingers or gloves. The grease left on the glass will form hot spots and shorten the life of the bulb. If the glass is accidentally touched, clean the glass with alcohol.

7. Connect the wiring connector firmly.
8. Turn the headlights ON and check both high and low beam function.
9. Turn the headlights OFF.
10. Reinstall the underhood fan, air switching valve, silencer, hoses and ducting (left side) or the coolant reservoir tank (right side).
11. Lower the hood.

RUBBER COVER TYPE

➧ See Figures 75, 76, 77, 78 and 79

1. With the ignition switch **OFF** and the headlamp switch OFF, raise and prop the hood.
2. Unplug the connector for the bulb.
3. Turn the plastic cover counterclockwise, then remove it.
4. Remove the rubber cover.
5. Release the bulb retaining spring, then remove the bulb.

To install:

6. Align the tabs of the bulb with the cutout of the mounting hole and install the bulb.
7. Install the retaining spring, then attach the rubber cover. Make sure the rubber cover is snug on the connector and the headlight body.
8. Install the plastic cover with the ON mark facing upwards. Turn it clockwise, then insert the connector.
9. Aiming is not necessary after replacing these types of bulbs.

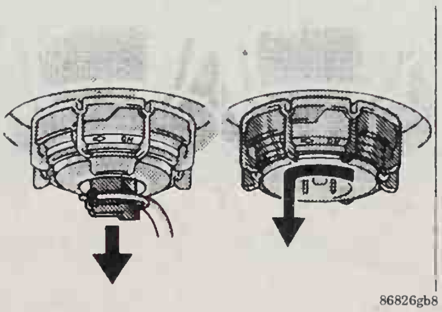


Fig. 75 Turn the bulb retaining ring counterclockwise, then remove the ring

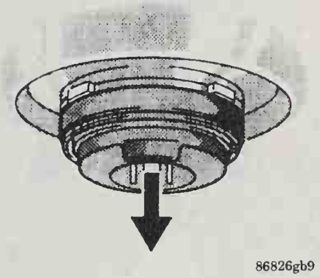


Fig. 76 Remove the rubber cover

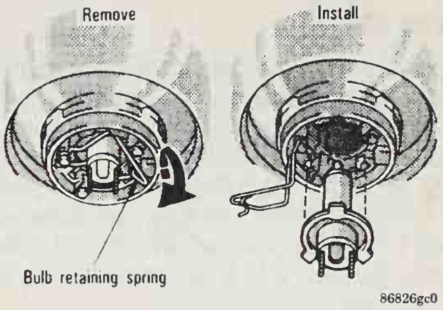


Fig. 77 Removing and installing the retaining spring

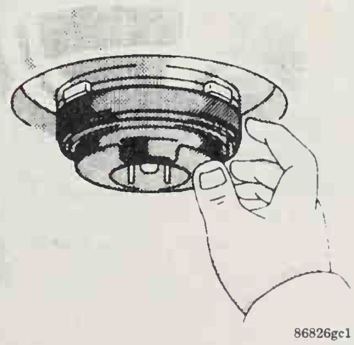


Fig. 78 Make sure the rubber cover is snug on the connector and the headlight body

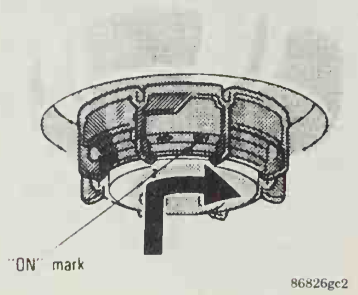

"ON" mark
86826gc2

Fig. 79 Install the plastic cover with the ON mark facing upwards. Turn it clockwise, then insert the connector

AIMING

Excluding Land Cruiser

➧ **See Figure 80**

The head lamps should be aimed using a special alignment tool, however this procedure may be used for temporary adjustment. Local regulations may vary regarding head lamp aiming, consult with your local authorities.

1. Verify the tires are at their proper inflation pressure. Clean the head lamp lenses and make sure there are no heavy loads in the trunk. The gas tank should be filled.
2. Position the vehicle on a level surface facing a flat wall 25 ft. (7.7 m) away.
3. Measure and record the distance from the floor to the center of the head lamp. Place a strip of tape across the wall at this same height.
4. Place strips of tape on the wall, perpendicular to the first measurement, indicating the vehicle centerline and the centerline of both head lamps.
5. Rock the vehicle side-to-side a few times to allow the suspension to stabilize.
6. Turn the lights on, adjust the head lamps to achieve a high intensity pattern.

Land Cruiser

➧ **See Figures 80 and 81**

1. Before checking the headlamp aim:
   a. Be sure that the body around the headlamp is not deformed.
   b. Park the vehicle on a level spot.
   c. Bounce in the vehicle a few times to get the truck at a level point.
2. Look at the beam angle gauge (vertical movement). The bubble of the gauge should not move out of the center of the gauge by more than two marks on either the upward or downward scale of the gauge.
3. Look at the beam angle gauge (horizontal movement). The red mark should not move by more than one mark on either side of the gauge.

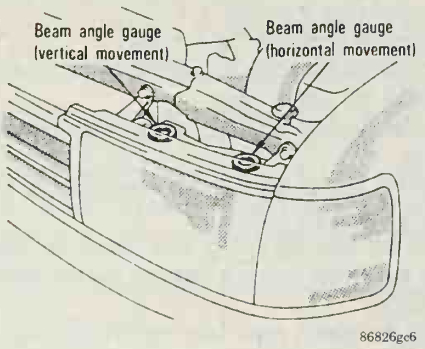

Beam angle gauge (vertical movement)
Beam angle gauge (horizontal movement)
86826gc6

Fig. 81 Land Cruisers have a bubble gauge to aid in aiming

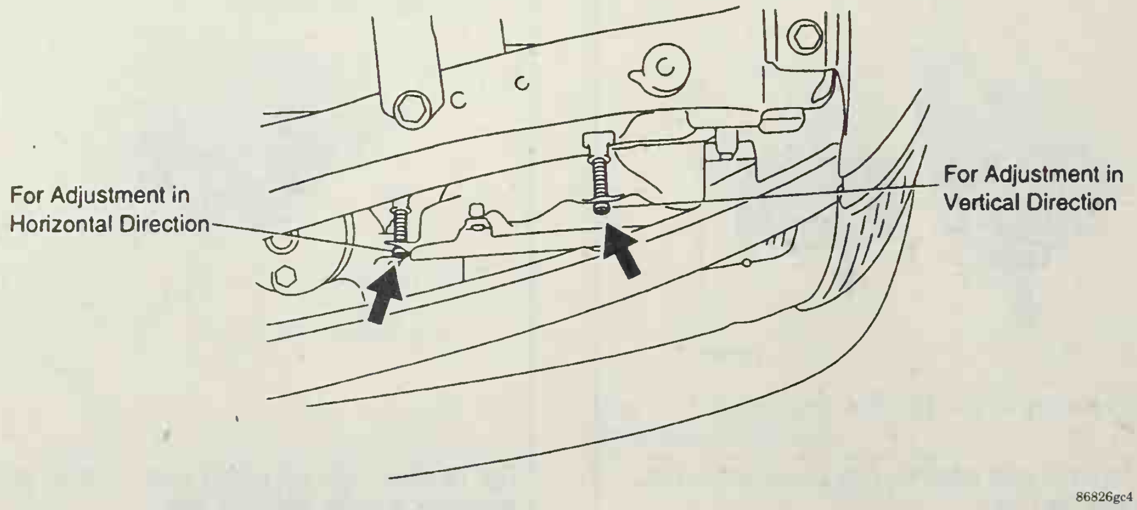

For Adjustment in Horizontal Direction
For Adjustment in Vertical Direction
86826gc4

Fig. 80 Headlamp adjusting screw locations

4. If the error is over the specified marks, take your vehicle to a specialized shop to have the headlamps adjusted professionally.

Signal, Marker and Interior Lamps

REMOVAL & INSTALLATION

➧ See Figures 82, 83, 84, 85, 86, 87 and 88

The lens is removed to allow access to the bulb. External lenses usually have a rubber gasket around them to keep dust and water out of the housing; the gasket must be present and in good condition at reinstallation. Exterior lenses and the larger interior ones are held by one or more screws which must be removed. Once the lens is removed from the body, the bulb is removed from the socket and replaced. For the rear lamps, front marker lamps and some front turn signals, the socket and bulb is removed from the lens with a counterclockwise turn.

Smaller interior lenses usually fit in place with plastic clips and must be pried or popped out of place. A small, flat, plastic tool is ideal for this job; if other tools are used, care must be taken not to break the lens or the clip.

The bulbs used on Toyota trucks are all US standard and may be purchased at any auto store or dealer. Because of the variety of lamps used on any vehicle, take the old one with you when shopping for the replacement.

On some models the lens can be replaced separately. On others, you have to replace the lens with the plastic backing attached.

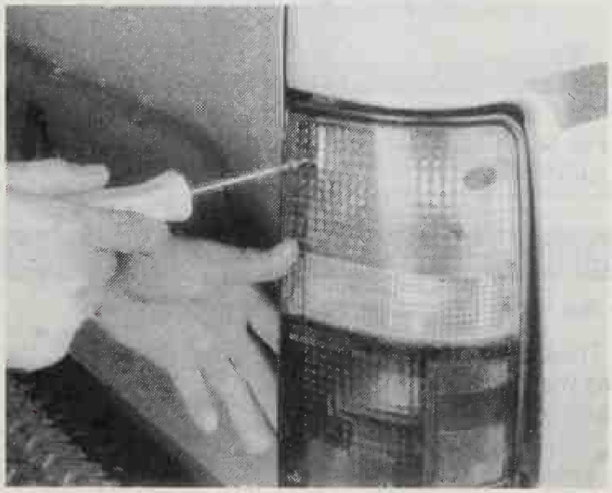


Fig. 82 Remove the screws securing the lens . . .

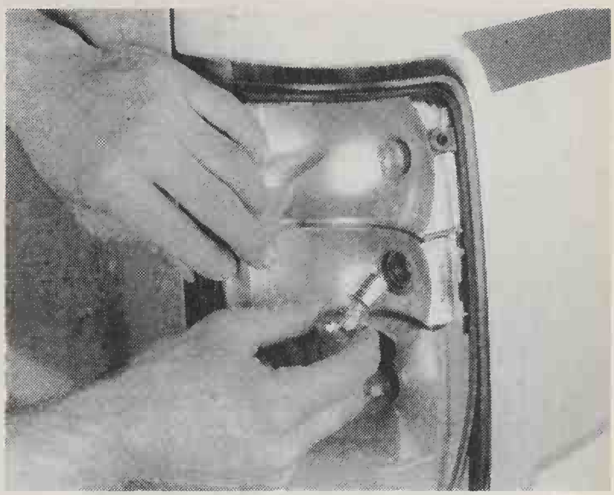


Fig. 83 . . . then twist and pull the bulb from the socket

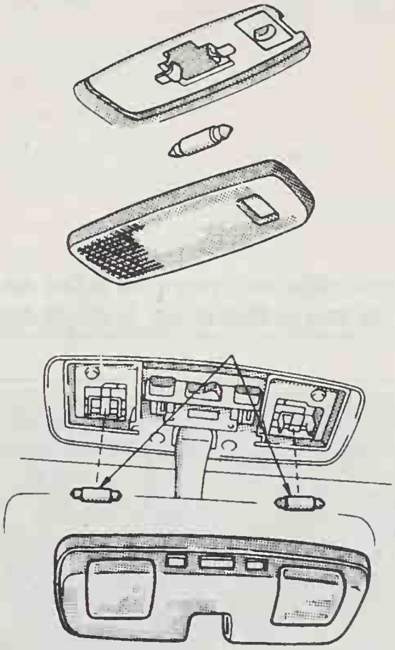


Fig. 84 Interior lamp lenses can generally be pried out of place

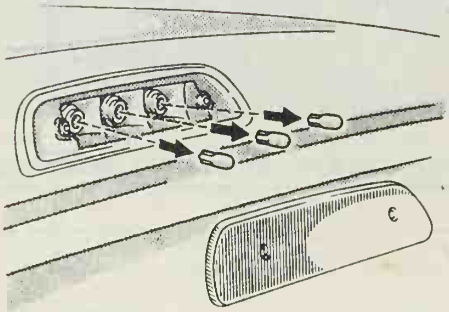


Fig. 85 Some bulbs may simply be pulled out after removing the lens — High-mount stoplight shown

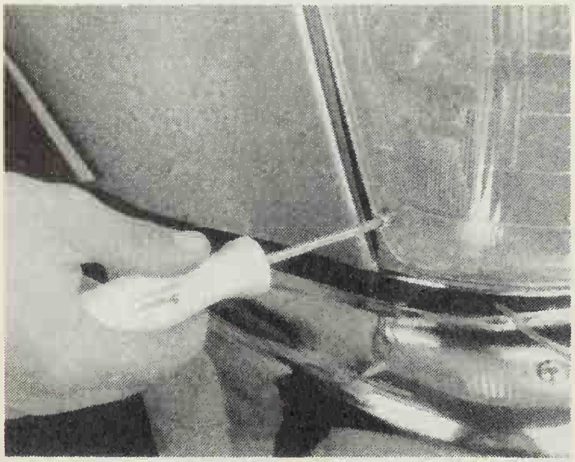


Fig. 86 The front parking light assemblies are secured by screws

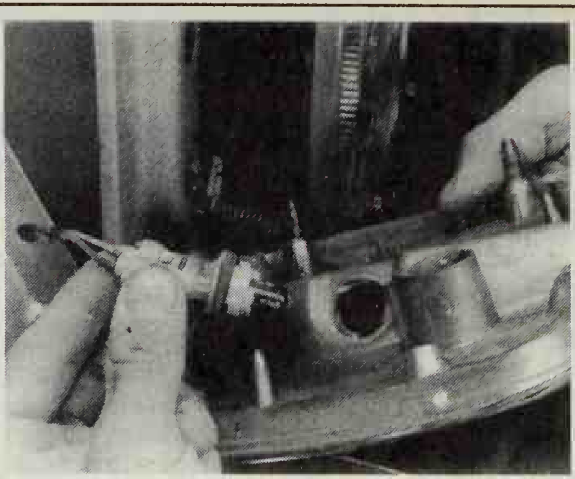


Fig. 87 On these types of lenses, twist then pull the socket and bulb from the housing

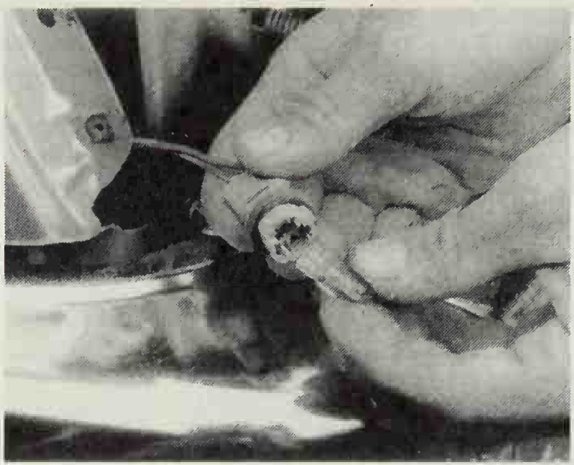


Fig. 88 The bulb can now simply be pulled from the socket

Light Bulb Applications

See Figures 89, 90, 91, 92, 93, 94 and 95

These charts should be used as a general reference. Please see your owner's manual for the exact specifications on your year and model.

No.	Light Bulbs	Bulb No.	Wattage
1	Front turn signal lights	1156	27
2	Parking lights	168	5
3	Front side marker lights	194	3.8
4	Rear side marker lights	194	3.8
5	Stop and tail lights	1157	27/8
6	Back-up lights	1156	27
7	Rear turn signal lights	1156	27
8	License plate lights	89	7 5
9	Interior light	–	10
10	Luggage compartment light	–	10
11	Glovebox light	–	1 2

86826ge1

Fig. 89 Light bulb applications — 1989-90 Land Cruiser

NOTICE:

Only use a bulb of the listed type.

Light Bulbs	Bulb No.	W	Type
Headlights (inner)	9005	65	A
Headlights (outer)	9006	55	B
Front turn signal lights	1156	27	C
Parking and front side marker lights	168	5	D
Rear side marker lights	194	3.8	D
Rear turn signal lights	1156	27	C
Stop and tail lights	1157	27/8	C
Back-up lights	1156	27	C

Light Bulbs	Bulb No.	W	Type
License plate lights	168	5	D
Interior lights	–	10	E
Personal light	–	10	C
Glovebox light	–	1.4	D
Luggage compartment light	–	10	E
Vanity lights	–	3	E

A : HB4 halogen bulbs
B : HB3 halogen bulbs
C : Single end bulbs
D : Wedge base bulbs
E : Double end bulbs

86826ge3

Fig. 91 Light bulb applications — 1993-95 Land Cruiser

No.	Light Bulbs	Bulb No.	Wattage
1	Front turn signal lights	1156	27
2	Parking and front side marker lights	168	5
3	Rear side marker lights	194	3 8
4	Stop and tail lights	1157	27 8
5	Back-up lights	1156	27
6	Rear turn signal lights	1156	27
7	License plate lights	89	5
8	Interior lights*	–	10
9	Personal light	–	10
10	Glovebox light	–	1 4
11	Luggage compartment light	–	10

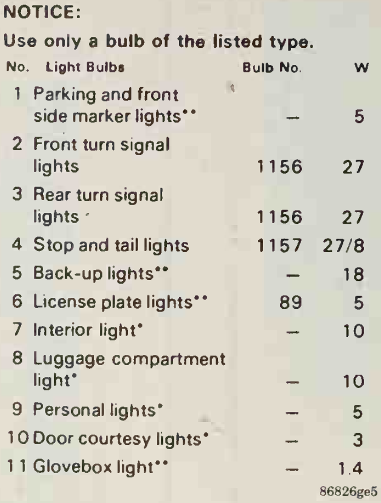
86826ge2

Fig. 90 Light bulb applications — 1991-92 Land Cruiser

No.	Light Bulbs	Bulb No.	Wattage
1	Parking lights	–	3 8
2	Front turn signal lights	1156	27
3	Rear turn signal lights	1156	27
4	Stop and tail lights	1157	27 8
5	Back-up lights	1156	27
6	License plate lights	–	3 8
7	Interior lights		
	Normal-cab	–	5
	Xtra-cab		
	Front	–	5
	Rear	–	10
8	Door courtesy lights*	–	3
9	Glovebox light	–	1.4

86826ge4

Fig. 92 Light bulb applications — 1989-91 Pick-Up and 4Runner



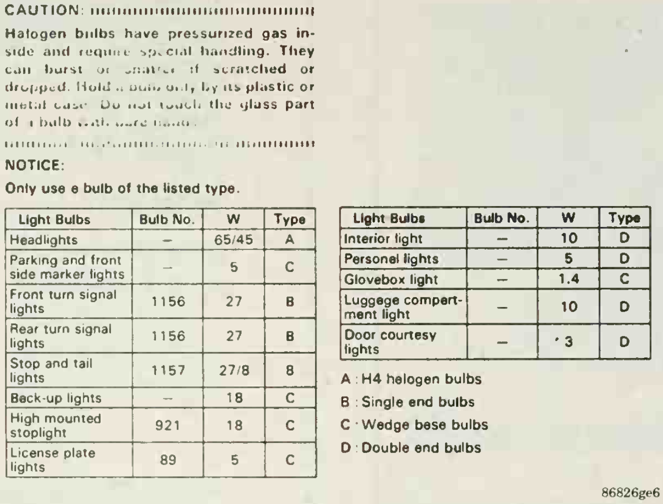
NOTICE:

Use only a bulb of the listed type.

No.	Light Bulbs	Bulb No.	W
1	Parking and front side marker lights**	–	5
2	Front turn signal lights	1156	27
3	Rear turn signal lights	1156	27
4	Stop and tail lights	1157	27/8
5	Back-up lights**	–	18
6	License plate lights**	89	5
7	Interior light*	–	10
8	Luggage compartment light*	–	10
9	Personal lights*	–	5
10	Door courtesy lights*	–	3
11	Glovebox light**	–	1.4

86826ge5

Fig. 93 Light bulb applications — 1992-93 Pick-Up and 4Runner



CAUTION:

Halogen bulbs have pressurized gas inside and require special handling. They can burst or shatter if scratched or dropped. Hold a bulb only by its plastic or metal case. Do not touch the glass part of a bulb with bare hands.

NOTICE:

Only use e bulb of the listed type.

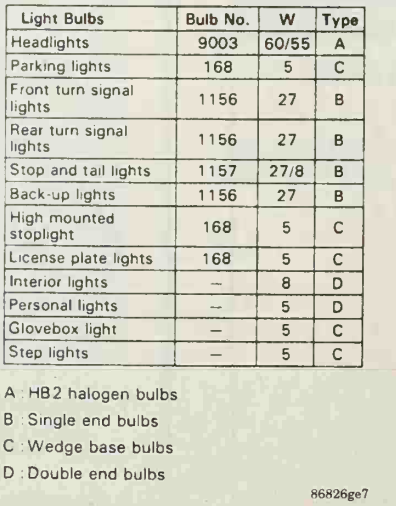
Light Bulbs	Bulb No.	W	Type
Headlights	–	65/45	A
Parking and front side marker lights	–	5	C
Front turn signal lights	1156	27	B
Rear turn signal lights	1156	27	B
Stop and tail lights	1157	27/8	B
Back-up lights	–	18	C
High mounted stoplight	921	18	C
License plate lights	89	5	C

Light Bulbs	Bulb No.	W	Type
Interior light	–	10	D
Personel lights	–	5	D
Glovebox light	–	1.4	C
Luggege compartment light	–	10	D
Door courtesy lights	–	3	D

A : H4 halogen bulbs
B : Single end bulbs
C : Wedge bese bulbs
D : Double end bulbs

86826ge6

Fig. 94 Light bulb applications — 1994-95 Pick-Up and 4Runner



Light Bulbs	Bulb No.	W	Type
Headlights	9003	60/55	A
Parking lights	168	5	C
Front turn signal lights	1156	27	B
Rear turn signal lights	1156	27	B
Stop and tail lights	1157	27/8	B
Back-up lights	1156	27	B
High mounted stoplight	168	5	C
License plate lights	168	5	C
Interior lights	–	8	D
Personal lights	–	5	D
Glovebox light	–	5	C
Step lights	–	5	C

A : HB2 halogen bulbs
B : Single end bulbs
C : Wedge base bulbs
D : Double end bulbs

86826ge7

Fig. 95 Light bulb applications — 1994-96 T100

TRAILER WIRING

Wiring the vehicle for towing is fairly easy. There are a number of good wiring kits available and these should be used, rather than trying to design your own.

All trailers will need brake lights and turn signals as well as tail lights and side marker lights. Most states require extra marker lights for overwide trailers. Also, most states have recently required back-up lights for trailers, and most trailer manufacturers have been building trailers with back-up lights for several years.

Additionally, some Class I, most Class II and just about all Class III trailers will have electric brakes. Add to this number an accessories wire, to operate trailer internal equipment or to charge the trailers battery, and you can have as many as seven wires in the harness.

Determine the equipment on your trailer and buy the wiring kit necessary. The kit will contain all the wires needed, plus a plug adapter set which included the female plug, mounted on the bumper or hitch, and the male plug, wired into, or plugged into the trailer harness.

When installing the kit, follow the manufacturers instructions. The color coding of the wires is usually standard throughout the industry. One point to note: some domestic vehicles, and most imported vehicles, have separate turn signals. On most domestic vehicles, the brake lights and rear turn signals operate with the same bulb. For those vehicles with separate turn signals, you can purchase an isolation unit so that the brake lights won't blink whenever the turn signals are operated, or, you can go to your local electronics supply house and buy four diodes to wire in series with the brake and turn signal bulbs. Diodes will isolate the brake and turn signals. The choice is yours. The isolation units are simple and quick to install, but far more expensive than the diodes. The diodes, however, require more work to install properly, since they require the cutting of each bulbs wire and soldering in place of the diode.

One, final point, the best kits are those with a spring loaded cover on the vehicle mounted socket. This cover prevent dirt and moisture from corroding the terminals. Never let the vehicle socket hang loosely; always mount it securely to the bumper or hitch.

CIRCUIT PROTECTION

Fuses

REPLACEMENT

➧ See Figure 96

The fuse block is located below the left side of the instrument panel on all vehicles. Additional fuses are found on the underhood relay board. The radio or audio unit is protected by an additional fuse in the body of the unit. In the event that anything electrical isn't working, the fuse should be the first item checked.

The underdash or underhood fusebox contains a fuse puller which can be used to grip and remove the fuse. The fuse cannot be checked while in the fuseblock; it must be removed. View the fuse from the side, looking for a broken element in the center. Sometimes the break is hard to see; if you can't check the fuse with an ohmmeter for continuity, replace the fuse.

If a fuse should blow, turn **OFF** the ignition switch and also the circuit involved. Replace the fuse with one of the same amperage rating, and turn on the switches. If the new fuse immediately blows out, the circuit should be tested for shorts, broken insulation, or loose connections.

➡Do not use fuses of a higher amperage than recommended.

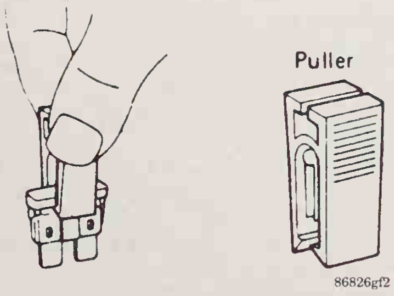


Fig. 96 A fuse puller can make replacement easier

Circuit Breakers

REPLACEMENT

See Figure 97

Many circuits, particularly high amperage ones, are protected by resetable circuit breakers. Much like the circuit breakers in a household system, these units will trip when too much current attempts to pass through. On Toyota vehicles, the breaker does not automatically reset, but may be reset manually.

To reset the breaker:

1. Disconnect the negative battery cable.
2. Remove the circuit breaker.
3. Use a needle probe or other thin tool to reach into the reset hole and push the reset button.

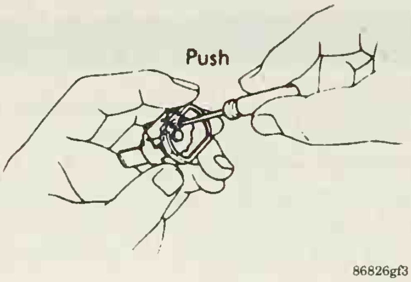


Fig. 97 Reset the circuit breaker with a small probe

4. Once reset, use an ohmmeter to check for continuity at the pins of breaker. If no continuity is present, the breaker did not reset.
5. Reinstall the circuit breaker and connect the negative battery cable.

Relays

REPLACEMENT

As vehicles rely more and more on electronic systems and electrically operated options, the number of relays grows steadily. Many relays are located in logical positions on the relay and fuse board under the dash or in the engine compartment. However, many relays are located throughout the vehicle, often near the component they control. During diagnosis of a circuit, always suspect a failed relay until proven otherwise.

Flashers

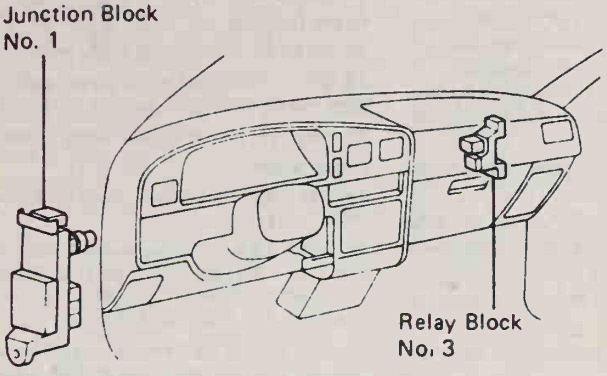
REPLACEMENT

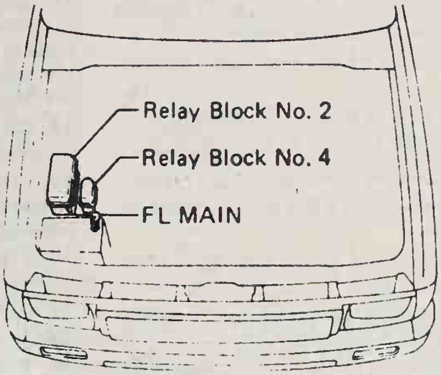
The turn signal flasher is located in the convenience center, under the dash, on the left side kick panel. In all cases, replacement is made by unplugging the old unit and plugging in a new one.

Fuse and Circuit Breaker Applications

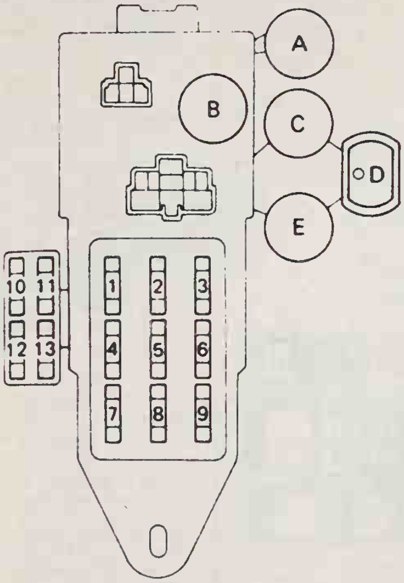
See Figures 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112 and 113

The following diagrams are to be used as a reference for locations. To obtain the exact fuse type, look in your owner's manual or on the label under the lid of each fuse box.


Junction Block No. 1
Relay Block No. 3


Relay Block No. 2
Relay Block No. 4
FL MAIN

Junction Block No. 1

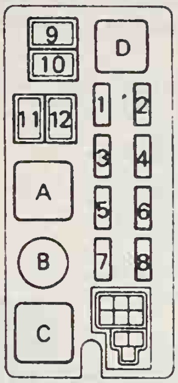

A
B
C
D
E
1
2
3
4
5
6
7
8
9
10
11
12
13

Fuses

1.	ENGINE	10A
2.	IGN	7.5A
3.	TAIL	15A
4.	WIPER	20A
5.	GAUGE	10A
6.	STOP	15A
7.	RADIO	7.5A
8.	CIG	15A
9.	TURN	10A
10.	RR ANTI LOCK	15A
11.	–	–
12.	ECU-IG	20A
13.	DEFOG	20A

Relays and Circuit Breaker
A. Starter Relay
B. Taillight Control Relay
C. Defogger Relay
D. Power (CB)
E. Moon Roof Relay

Relay Block No. 2


9
10
D
11
12
1
2
3
4
A
5
6
B
7
8
C

Fuses

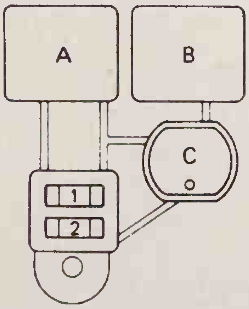
1.	CHARGE	7.5A
2.	EFI	15A
3.	HAZ-HORN	15A
4.	DOME	15A
5.	HEAD (RH)	10A
6.	HEAD (LH)	10A
7.	–	–
8.	–	–
9.	ALT (H-Fuse) (22R-E A/T)	80A 100A
10.	–	–
11.	AM1 (H-Fuse)	40A
12.	AM2 (H-Fuse)	30A

Relays
A. Headlight Control Relay
B. EFI Relay
(CANADA Models)
Fuses

5.	HEAD (RH-LO)	10A
6.	HEAD (LH-LO)	10A
7.	HEAD (RH-HI)	10A
8.	HEAD (LH-HI)	10A

Relays
D. Dimmer Relay

Relay Block No. 3

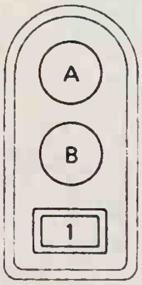


Fuses

1.	A/C	10A
2.	RR HEATER	20A

Relays and Circuit Breaker
A. RR Heater Relay
B. Heater Relay
C. Heater (CB)

Relay Block No. 4



Fuse

1.	CDS FAN	30A

Relays
A. CDS FAN No. 1 Relay
B. CDS FAN No. 2 Relay

86826gf5

Fig. 98 Fuse and circuit breaker locations — 1989-91 4Runner

Fuses (type A)

1. EFI 10 A: Electronic fuel injection system

2. DOME 15 A: Interior light, personal lights, luggage compartment light, door courtesy lights, clock, ignition switch light

3. HAZ-HORN 15 A: Emergency flashers, horns

4. HEAD (LH) 10 A: Left-hand headlight

5. HEAD (RH) 10 A: Right-hand headlight

6. DRL 7.5 A: Daytime running light system

7. HEAD (LH-LO) 10 A: Left-hand headlight (low beam)

8. HEAD (RH-LO) 10 A: Right-hand headlight (low beam)

9. HEAD (LH-HI) 10 A: Left-hand headlight (high beam)

10. HEAD (RH-HI) 10 A: Right-hand headlight (high beam)

11. ENGINE 10 A: Cruise control system, charging system

12. WIPER 20 A: Windshield wiper and washer, back window wiper and washer

13. RADIO 7.5 A: Radio, power antenna, cassette tape player, Compact Disc player, power rear view mirrors

14. IGN. 7.5 A: Discharge warning light, emission control system, electronically controlled automatic transmission system

15. GAUGES 10 A: Automatic transmission overdrive control system, gauges and meters, warning lights and buzzers (except discharge warning light), A.D.D. control system

16. CIG. 15 A: Cigarette lighter, digital clock display, radio

17. TAIL 15 A: Tail lights, parking and side marker lights, license plate lights, instrument panel lights, glovebox light

18. STOP 15 A: Stop lights, cruise control system cancel device

19. TURN 10 A: Turn signal lights, back-up lights

20. REAR ANTILOCK 15 A: Rear-wheel anti-lock brake system

21. ECU-IG 20 A: Power steering control system, shift lock control system (automatic transmission)

22. DEFOG 20 A: Back window defogger

23. A/C 10 A: Air conditioning cooling system

24. RR HEATER 20 A: Rear air conditioning control system

Fuses (type B)

25. 30 A: Air conditioning fan system

26. 30 A: Power windows, power back window, power door locks, electric moon roof

27. 40 A: Air conditioning control system

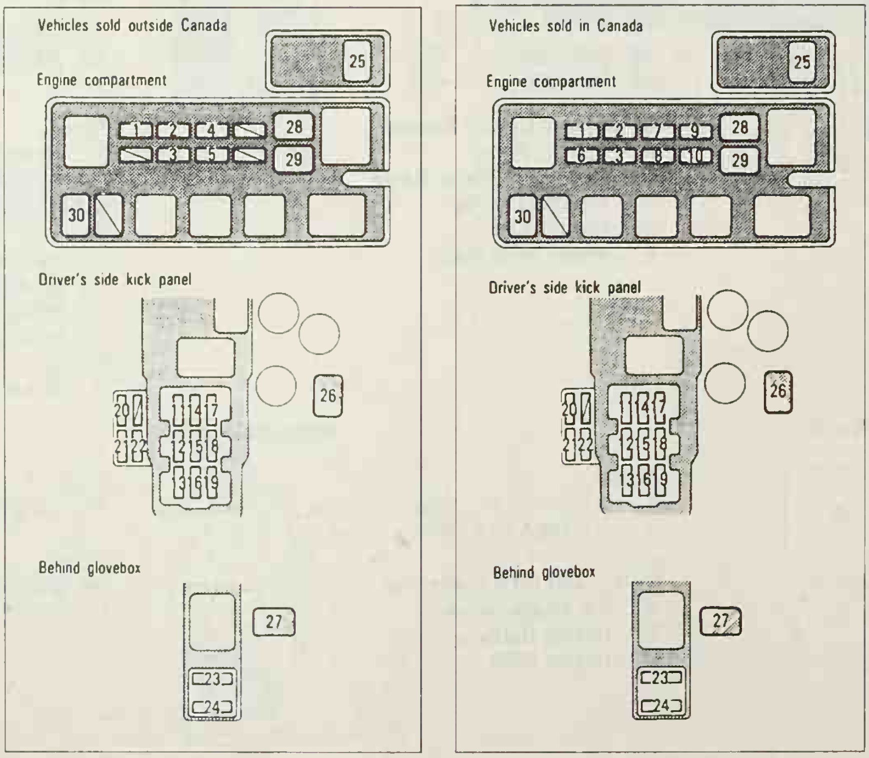
Fuses (type C)

28. AM2 30 A: All components in "EFI" and "IGN" fuses

29. AM1 40 A: Starting system, all components in "ENGINE", "WIPER", "RADIO", "GAUGES", "CIG", "TURN", "ECU-IG", "DEFOG" fuses and No. 26 fuse

30. ALT 80A (22R-E engined vehicles with manual transmission and 3VZ-E engined vehicles) or ALT 100A (22R-E engined vehicles with automatic transmittion): Starting system, all components in "ENGINE", "WIPER", "RADIO", "GAUGES", "CIG", "TAIL", "STOP", "TURN", "ECU-IG", "DEFOG" fuses and No. 26 fuse

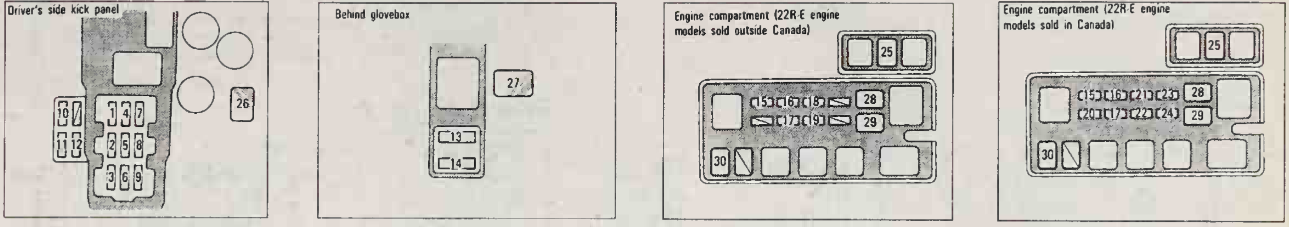
Fuses

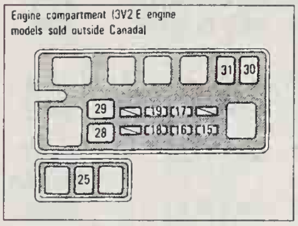


86826gf7

Fig. 99 Fuse and circuit breaker locations — 1992-94 4Runner

Fuses


Driver's side kick panel
10
11
12
1
4
7
2
5
8
3
6
9
26
Behind glovebox
27
13
14
Engine compartment (22R-E engine models sold outside Canada)
25
15
16
18
28
17
19
29
30
Engine compartment (22R-E engine models sold in Canada)
25
15
16
21
23
28
20
17
22
24
29
30


Engine compartment (3VZ-E engine models sold outside Canada)
31
30
29
19
17
28
18
16
15
25

Fuses (type A)

1. **ENGINE 10 A:** Cruise control system (22R-E engine), charging system

2. **WIPER 20 A:** Windshield wiper and washer, back window wiper and washer

3. **RADIO 7.5 A:** Radio, power antenna, cassette tape player, Compact Disc player, power rear view mirrors

4. **IGN. 7.5 A:** Discharge warning light, emission control system, electronically controlled automatic transmission system

5. **GAUGES 10 A:** Automatic transmission overdrive control system, gauges and meters, service reminder indicators and warning buzzers (except discharge warning light), A.D.D. control system, back-up lights

6. **CIG. 15 A:** Cigarette lighter, digital clock display, radio

7. **TAIL 15 A:** Tail lights, parking and side marker lights, license plate lights, instrument panel lights, glovebox light

8. **STOP 15 A:** Stop lights, cruise control system cancel device, high mounted stoplight

9. **TURN 10 A:** Turn signal lights

10. **REAR ANTILOCK 15 A:** Rear-wheel antilock brake system

11. **ECU-IG 20 A:** Power steering control system, shift lock control system (automatic transmission), cruise control system (3VZ-E engine)

12. **DEFOG 20 A:** Back window defogger

13. **A/C 10 A:** Air conditioning cooling system

14. **RR HEATER 20 A:** Rear air conditioning control system

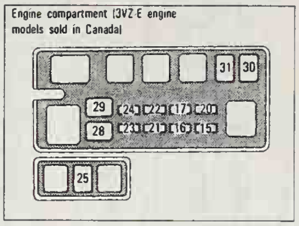
15. **EFI 15 A:** Multiport fuel injection system/sequetial multiport fuel injection system

16. **DOME 15 A:** Interior light, personal lights, luggage compartment light, door courtesy lights, clock, ignition switch light

17. **HAZ-HORN 15 A:** Emergency flashers, horns

18. **HEAD (LH) 10 A:** Left-hand headlight

19. **HEAD (RH) 10 A:** Right-hand headlight


Engine compartment (3VZ-E engine models sold in Canada)
31
30
29
24
22
17
20
28
23
21
16
15
25

20. **DRL 7.5 A:** Daytime running light system

21. **HEAD (LH-LO) 10 A:** Left-hand headlight (low beam)

22. **HEAD (RH-LO) 10 A:** Right-hand headlight (low beam)

23. **HEAD (LH-HI) 10 A:** Left-hand headlight (high beam)

24. **HEAD (RH-HI) 10 A:** Right-hand headlight (high beam)

Fuses (type B)

25. **30 A:** Air conditioning fan system

26. **30 A:** Power windows, power back window, power door locks, electric moon roof

27. **40 A:** Air conditioning control system

Fuses (type C)

28. **AM2 30 A:** All components in "EFI" and "IGN" fuses

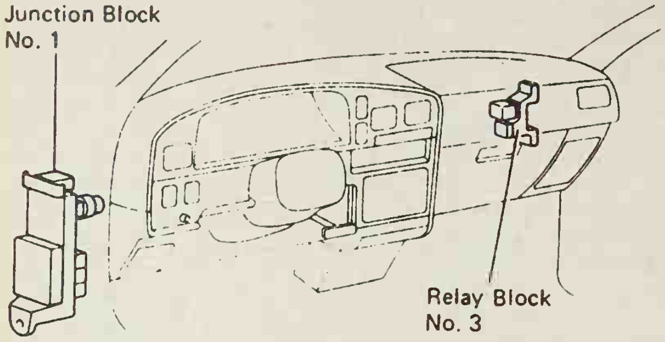
29. **AM1 40 A:** Starting system, all components in "ENGINE", "WIPER", "RADIO", "GAUGES", "CIG", "TURN", "ECU-IG", "DEFOG" fuses and No. 26 fuse

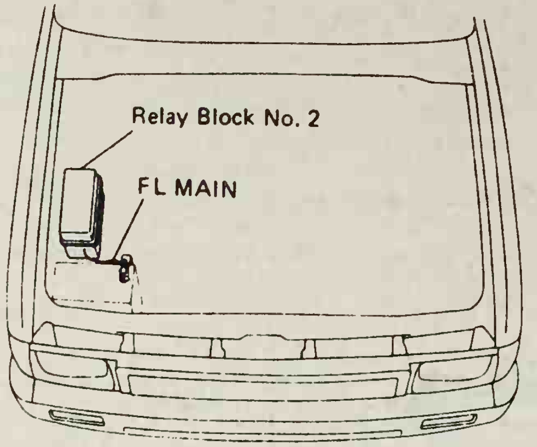
30. **ALT 80A (22R-E engined vehicles with a manual transmission end 3VZ-E engined vehicles) or ALT 100A (22R-E engined vehicles with an automatic transmittion):** Starting system, all components in "ENGINE", "WIPER", "RADIO", "GAUGES", "CIG", "TAIL", "STOP", "TURN", "ECU-IG", "DEFOG" fuses and No. 26 fuse

31. **ABS 60 A:** Anti-lock brake system

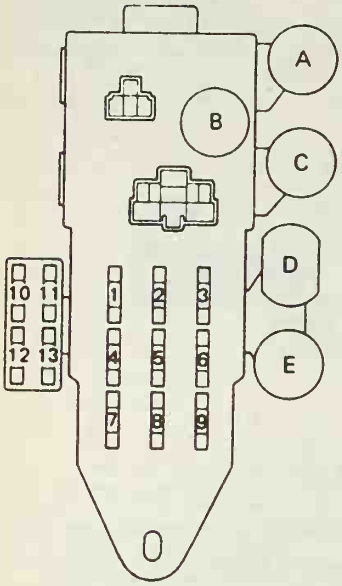
86826gf8

Fig. 100 Fuse and circuit breaker locations — 1995 4Runner


Junction Block No. 1
Relay Block No. 3


Relay Block No. 2
FL MAIN

Junction Block No. 1


A
B
C
D
E
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8
9
10
11
12
13

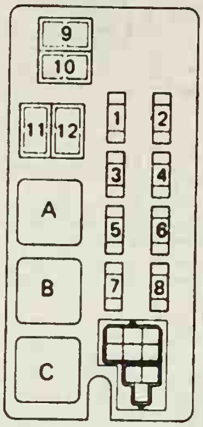
Fuses

1.	ENGINE	10A
2.	IGN	7.5A
3.	TAIL	15A
4.	WIP	20A
5.	GAUGE	10A
6.	STOP	15A
7.	RADIO	7.5A
8.	CIG	15A
9.	TURN	10A
10.	–	–
11.	–	–
12.	ECU-IG	20A
13.	DEFOG	15A

Relays and Circuit Braker

- A. Starter or Back Up Relay
- B. Taillight Control Relay
- C. Defogger Relay [w/o Power Window]
- D. Power (CB)
- E. Defogger Relay [w/ Power Window]

Relay Block No. 2


9
10
11
12
1
2
3
4
5
6
7
8
A
B
C

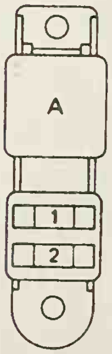
Fuses

1.	CHARGE	7.5A
2.	EFI	15A
3.	HAZ-HORN	15A
4.	DOME	15A
5.	HEAD (RH)	10A
6.	HEAD (LH)	10A
7.	–	–
8.	–	–
9.	ALT (FL)	80A
10.	–	–
11.	AM1 (FL)	40A or 60A
12.	AM2 (FL)	30A

Relays

- A. Headlight Control Relay
- B. EFI Relay
- C. CMH Relay

Relay Block No. 3



Fuses

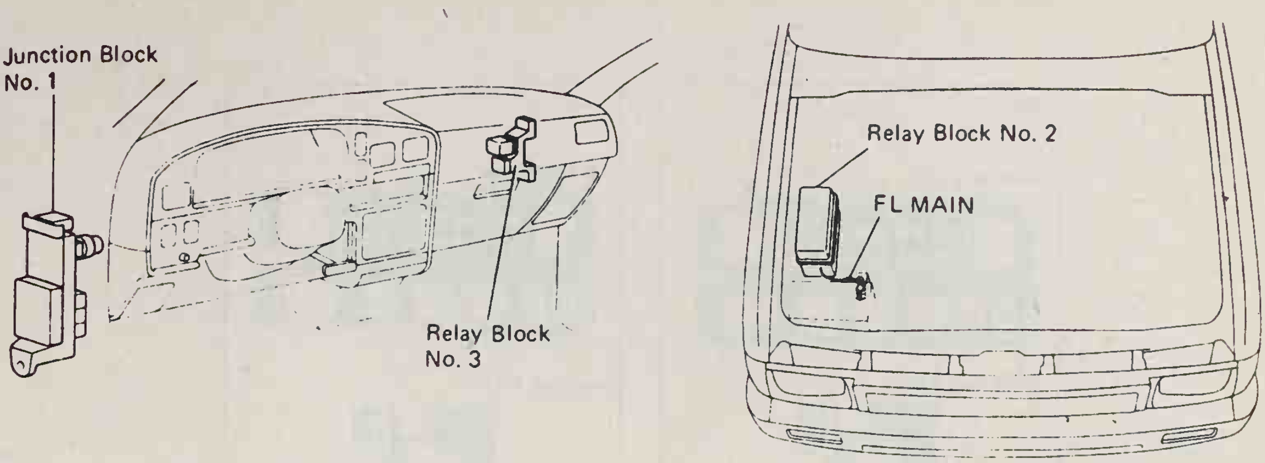
1.	A/C	10A
2.	HEATER	30A

Relay

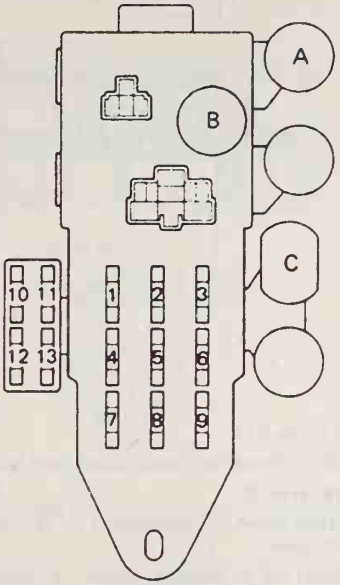
- A. Heater Relay

86826gf9

Fig. 101 Fuse and circuit breaker locations — 1989-90 Pick-Up


Junction Block No. 1
Relay Block No. 3
Relay Block No. 2
FL MAIN

Junction Block No. 1

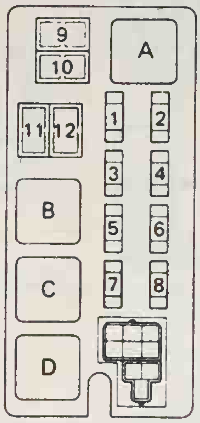

A
B
C
10
11
12
13
1
2
3
4
5
6
7
8
9

Fuses

1.	ENGINE	10A
2.	IGN	7.5A
3.	TAIL	15A
4.	WIPER	20A
5.	GAUGE	10A
6.	STOP	15A
7.	RADIO	7.5A
8.	CIG	15A
9.	TURN	10A
10.	REAR ANTILOCK	15A
11.	–	–
12.	ECU-IG	20A
13.	–	–

Relays and Circuit Braker
A. Starter or Back Up Relay
B. Taillight Control Relay
C. Power (CB)

Relay Block No. 2

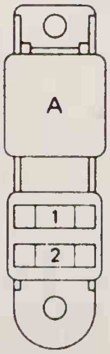

9
10
A
11
12
1
2
3
4
5
6
7
8
B
C
D

Fuses

1.	CHARGE	7.5A
2.	EFI	15A
3.	HAZ-HORN	15A
4.	DOME	15A
5.	(USA) HEAD (RH)	10A
6.	(USA) HEAD (LH)	10A
7.	–	–
8.	–	–
9.	ALT (H-fuse)	80A
10.	–	–
11.	AM1 (H-fuse)	40A or 60A
12.	AM2 (H-fuse) (CANADA)	30A
5.	HEAD LO (RH)	10A
6.	HEAD LO (LH)	10A
7.	HEAD HI (RH)	10A
8.	HEAD HI (LH)	10A

Relays
A. (CANADA) Headlight Dimmer Relay
B. Headlight Control Relay
C. EFI Relay
D. CMH Relay

Relay Block No. 3



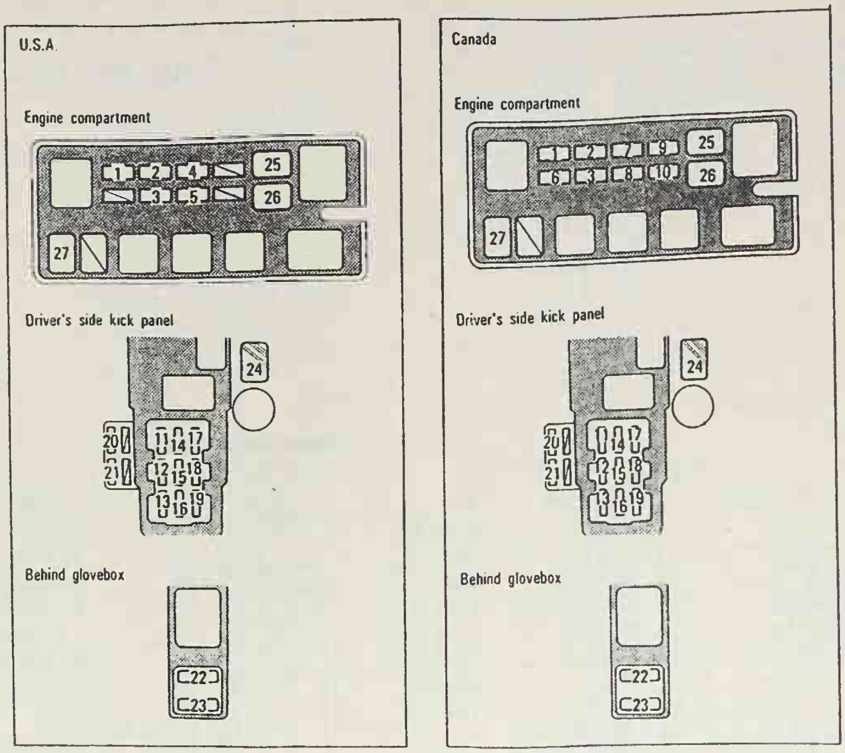
Fuses

1.	A/C	10A
2.	HEATER	30A

Relay
A. Heater Relay

86826gg2

Fig. 102 Fuse and circuit breaker locations — 1991 Pick-Up


U.S.A.
Engine compartment
1
2
4
25
3
5
26
27
Driver's side kick panel
24
20
21
14
17
12
18
15
13
19
16
Behind glovebox
22
23
Canada
Engine compartment
1
2
7
9
25
6
3
8
10
26
27
Driver's side kick panel
24
20
21
14
18
19
16
Behind glovebox
22
23

Fuses (type A)

1. EFI 10 A: Electronic fuel injection system

2. DOME 15 A: Interior lights, door courtesy lights, clock, ignition switch light

3. HAZ-HORN 15 A: Emergency flashers, horns

4. HEAD (LH) 10 A: Left-hand headlight

5. HEAD (RH) 10 A: Right-hand headlight

6. DRL 7.5 A: Daytime running light system

7. HEAD (LH-LO) 10 A: Left-hand headlight (low beam)

8. HEAD (RH-LO) 10 A: Right-hand headlight (low beam)

9. HEAD (LH-HI) 10 A: Left-hand headlight (high beam)

10. HEAD (RH-HI) 10 A: Right-hand headlight (high beam)

11. ENGINE 10 A: Cruise control system, charging system

12. WIPER 20 A: Windshield wiper and washer

13. RADIO 7.5 A: Radio, cassette tape player, power rear view mirrors

14. IGN. 7.5 A: Discharge warning light, emission control system, electronically controlled automatic transmission system

15. GAUGES 10 A: Automatic transmission overdrive control system, gauges and meters, warning lights and buzzers (except discharge warning light), A.D.D. control system

16. CIG. 15 A: Cigarette lighter, digital clock display, radio

17. TAIL 15 A: Tail lights, parking lights, license plate lights, instrument panel lights, glovebox light

18. STOP 15 A: Stop lights, cruise control system cancel device

19. TURN 10 A: Turn signal lights, back-up lights

20. RR ANTI LOCK 15 A: Rear-wheel anti-lock brake system

21. ECU-IG 20 A: Power steering control system, shift lock control system (automatic transmission), rear-wheel anti-lock brake system

22. A/C 10 A: Air conditioning cooling system

23. HEATER 30 A: Air conditioning system

Fuse (type B)

24. 30 A: Power windows, power door locks

Fuses (type C)

25. AM2 30 A: All components in "EFI" and "IGN" fuses

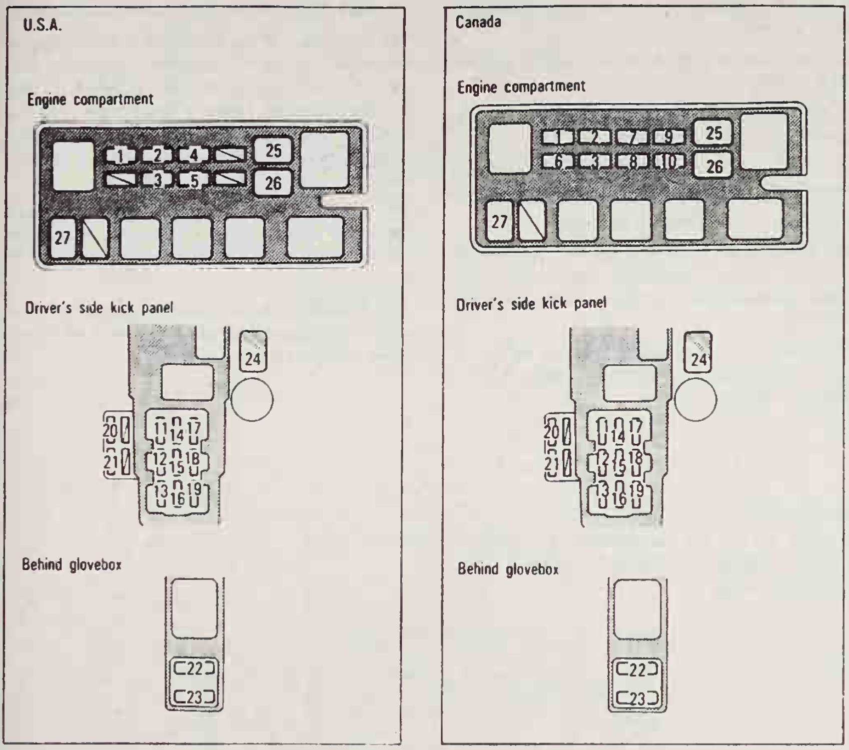
26. AM1 40 A: Starting system, all components in "TURN", "GAUGES", "CIG", "ENGINE", "WIPER", "RADIO", "ECU-IG" fuses and type B fuse

27. ALT 80 A: Starting system, all components in "TAIL", "STOP", "TURN", "GAUGES", "CIG", "ENGINE", "WIPER", "RADIO", "ECU-IG", "A/C", "HEATER" fuses and type B fuse

86826gg1

Fig. 103 Fuse and circuit breaker locations — 1992 Pick-Up

Fuses


U.S.A.
Engine compartment
1
2
4
25
3
5
26
27
Driver's side kick panel
24
20
21
14
17
12
15
18
13
16
19
Behind glovebox
22
23
Canada
Engine compartment
1
2
7
9
25
6
3
8
10
26
27
Driver's side kick panel
24
20
21
14
17
12
15
18
13
16
19
Behind glovebox
22
23

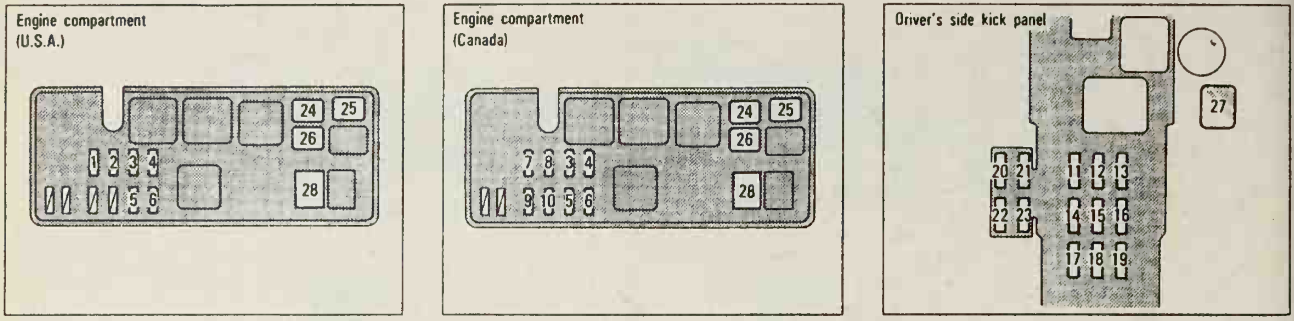
Fuses (type A)

1. **EFI 15 A:** Multiport fuel injection system/ sequential multiport fuel injection system
2. **DOME 15 A:** Interior lights, door courtesy lights, clock, ignition switch light
3. **HAZ-HORN 15 A:** Emergency flashers, horns
4. **HEAD (LH) 10 A:** Left-hand headlight
5. **HEAD (RH) 10 A:** Right-hand headlight
6. **DRL 7.5 A:** Daytime running light system
7. **HEAD (LH-LO) 10 A:** Left-hand headlight (low beam)
8. **HEAD (RH-LO) 10 A:** Right-hand headlight (low beam)
9. **HEAD (LH-HI) 10 A:** Left-hand headlight (high beam)
10. **HEAD (RH-HI) 10 A:** Right-hand headlight (high beam)
11. **ENGINE 10 A:** Cruise control system, charging system
12. **WIPER 20 A:** Windshield wiper and washer
13. **RADIO 7.5 A:** Radio, cassette tape player, power rear view mirrors

86826gg4

Fig. 104 Fuse and circuit breaker locations — 1993-95 Pick-Up

Fuses



Fuses (type A)

1. HEAD (LH) 10 A: Left-hand headlight

2. HEAD (RH) 10 A: Right-hand headlight

3. A/C 10 A: Air conditioning cooling system

4. EFI 15 A: Multiport fuel injection system/ sequential multiport fuel injection system, electronically controlled automatic transmission system

5. HAZ-HORN 15 A: Emergency flashers, horns

6. DOME 15 A: Interior light, personal lights, step lights, ignition switch light, radio, cassette tape player, Compact Disc player, power antenna, clock

7. HEAD (LH-HI) 10 A: Left-hand headlight (high beam)

8. HEAD (RH-HI) 10 A: Right-hand headlight (high beam)

9. HEAD (LH-LO) 10 A (3VZ-E engine): Left-hand headlight (low beam)

10. HEAD (RH-LO) 10 A (3VZ-E engine): Right-hand headlight (low beam)

11. ENG 10 A: Charging system

12. IGN 7.5 A: Charging system, discharge warning light, multiport fuel injection system/sequential multiport fuel injection system

13. TAIL 15 A: Tail lights, parking lights, license plate lights, instrument panel lights, glovebox light

14. WIP 20 A: Windshield wiper and washer

15. GAUGE 10 A: Automatic transmission overdrive control system, gauges and meters, service reminder indicators and warning buzzers (except discharge warning light), A.D.D. control system, cruise control system, back-up lights, power door lock system

16. STOP 15 A: Stop lights, High-mounted stoplight, cruise control system, electronically controlled automatic transmission system

17. RADIO 7.5 A: Radio, cassette tape player, Compact Disc player, power antenna, power rear view mirrors

18. CIG 15 A: Cigarette lighter, digital clock display, shift lock control system (automatic transmission)

19. TURN 10 A: Turn signal lights, emergency flashers

20. ECU-B 15 A: Rear-wheel anti-lock brake system, SRS airbag system, cruise control system, daytime running light system

21. DRL 7.5 A (Canada): Daytime running light system

ABS 15 A (U.S.A): Rear-wheel anti-lock brake system

22. ECU-IG 20 A: Rear-wheel anti-lock brake system

23. OBD II 7.5 A (3RZ-FE engine): Check connecter

Fuses (type B)

24. AM1 40 A: Starting system, all components in "ENG", "IGN", "WIP", "GAUGE". "RADIO", "CIG", "TURN" and "PWR" fuses

25. AM2 30 A: Starting system, all components in "ENG", "IGN", "WIP", "GAUGE",

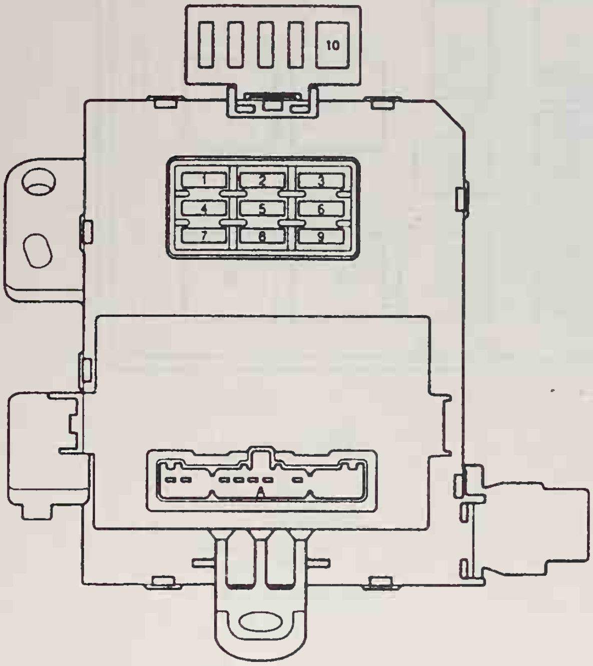
Fuse (type C)

28. ALT 80 A: All components in "A/C", "TAIL", "STOP", "ECU-B", "AM1" and "HEATER" fuses

86826gg5

Fig. 105 Fuse and circuit breaker locations — T100

Front Side



Relay
- A. Integration Relay

Fuse

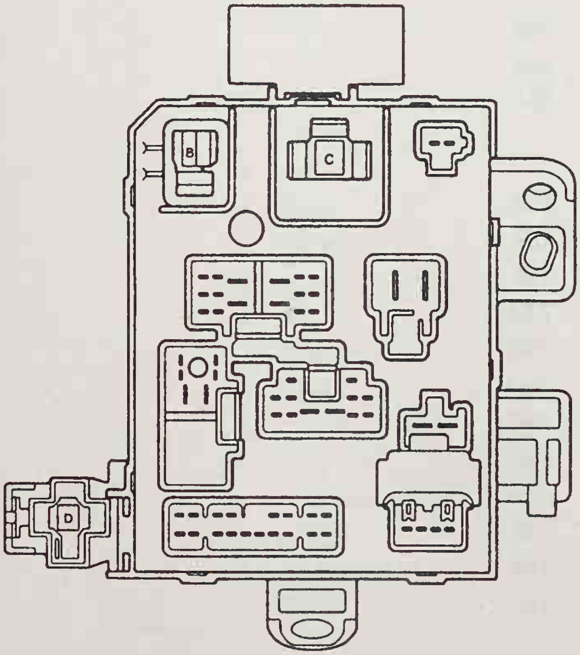
Medium Current Fuse

10.	POWER	30A

Fuses

1.	4WD	15A
2.	GAUGE	10A
3.	TURN	10A
4.	ECU-IG	15A
5.	WIPER	20A
6.	IGN	7.5A
7.	RADIO	7.5A
8.	CIG	15A
9.	ECU-B	15A

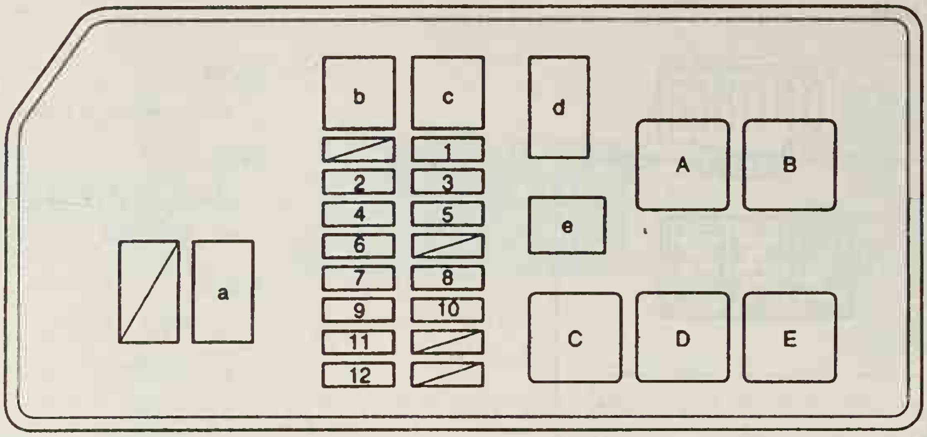
Rear Side



Relays
- B. HORN
- C. FLASHER
- D. BACK-UP LIGHT (Column A/T)

86826gg6

Fig. 106 Fuse and circuit breaker locations — Tacoma



Relays

- A. TAIL
- B. HEATER
- C. HEAD
- D. STARTER
- E. EFI

Fuses

High Current Fuse

a. ALT	80A
d. ABS	60A

Medium Current Fuses

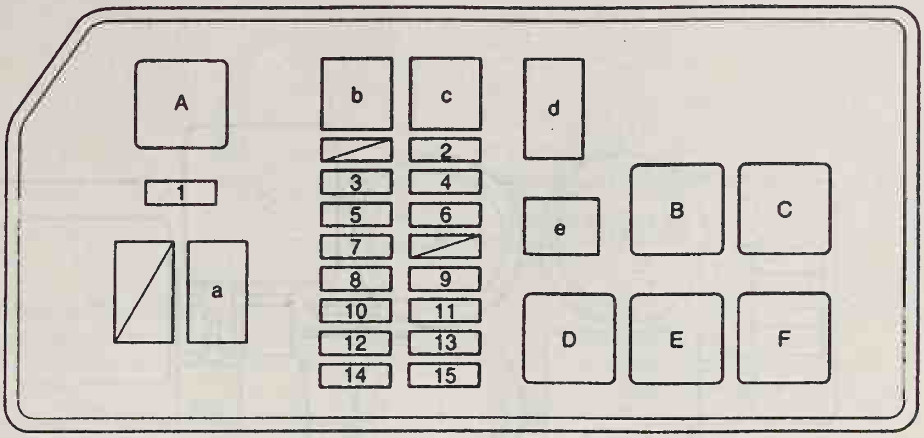
b. HEATER	40A
c. AM1	40A
e. AM2	30A

Fuses

1. TAIL	10A
2. STOP	15A
3. PANEL	10A
4. ALT-S	7.5A
5. A/C	10A
6. STA	7.5A
7. OBD	10A
8. HEAD (RH)	10A
9. EFI	15A
10. HEAD (LH)	10A
11. HORN	15A
12. DOME	15A

86826gg7

Fig. 107 Fuse and circuit breaker locations — U.S Tacoma models



Relays

- A. DIMMER
- B. TAIL
- C. HEATER
- D. HEAD
- E. STARTER
- F. EFI

Fuses

High Current Fuse	
a. ALT	80A
d. ABS	60A
Medium Current Fuses	
b. HEATER	40A
c. AM1	40A
e. AM2	30A

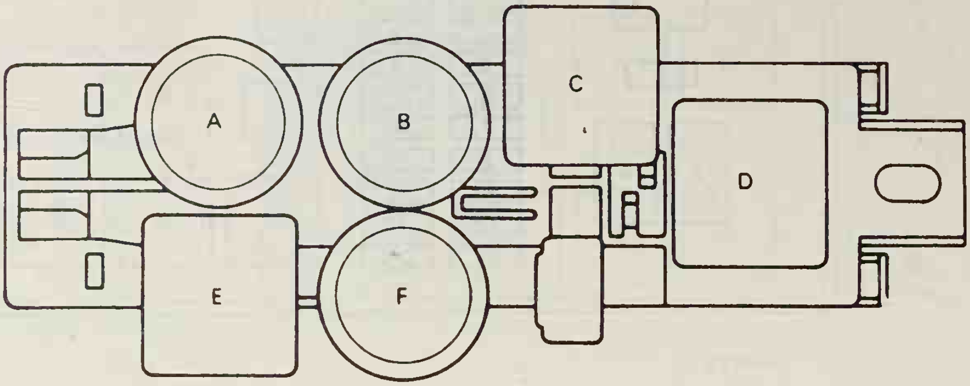
Fuses

1. DRL	7.5A
2. TAIL	10A
3. STOP	15A
4. PANEL	10A
5. ALT-S	7.5A
6. A/C	10A
7. STA	7.5A
8. OBD	10A
9. HEAD (HI RH)	10A
10. EFI	15A
11. HEAD (HI LH)	10A
12. HORN	15A
13. HEAD (LO RH)	10A
14. DOME	15A
15. HEAD (LO LH)	10A

86826gg8

Fig. 108 Fuse and circuit breaker locations — Canadian Tacoma models

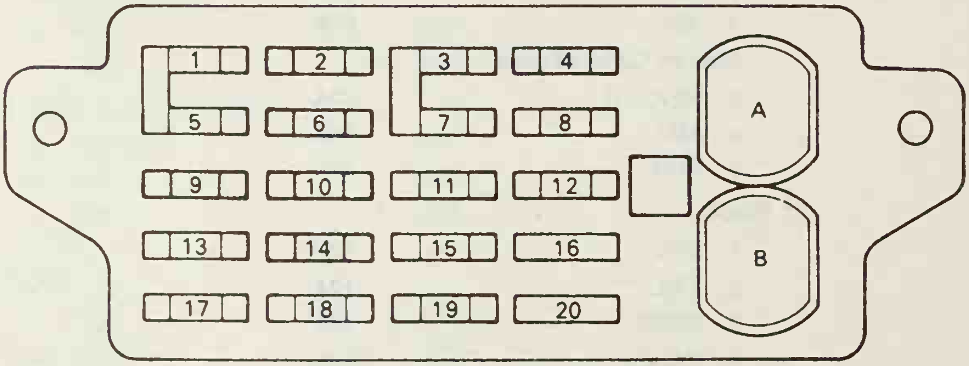
Relay Block



Relays

A. Taillight Control Relay
B. Front Drive Relay
C. Front Heater Relay
D. Turn Signal Flasher
E. Headlight Control Relay
F. Ignition Main Relay

Fuse Block



Fuses

1.	HEAD (RH)	15A
2.	TAIL	15A
3	TURN	7.5A
4	DOOM	7.5A
5.	HEAD (LH)	15A
6.	STOP	15A
7.	WIPER	20A
8.	CHARGE	7.5A
9	CIG	15A
10.	HAZ-HORN	15A
11	A/C	10A
12.	GAUGE	7.5A
13.	DOOR	15A
14.	ENGINE	10A
15.	–	
16.	SPARE	7.5A
17.	EFI	15A
18.	IGN	7.5A
19.	DEFOG	20A
20.	SPARE	15A

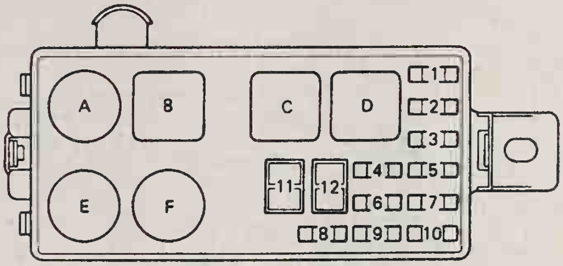
Circuit Breakers

A.	Heater	30A
B.	Power	30A

86826gh0

Fig. 109 Fuse and circuit breaker locations — 1989-90 Land Cruiser

Relay Block No. 2 (Engine Room)



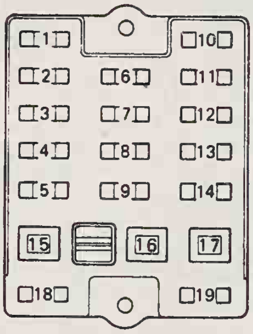
Fuse and High Current Fuses

1.	HEAD (RH)	15A	7.	HAZ-HORN	15A
2.	HEAD (LH)	15A	8.	–	
3.	–		9.	–	
4.	CHARGE	7.5A	10.	DOME	10A
5.	–		11.	AM1	50A
6.	EFI	15A	12.	–	

Relays

A. EFI Main Relay
8. Cherge Light Relay
C. Headlight Control Relay
D. –
E. Horn Relay
F. –

Fuse Block (Instrument Panel)



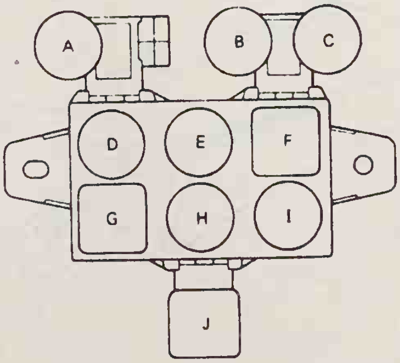
Fuse and Medium Current Fuse

1.	CIG	15A	10.	ECU-B	10A
2.	TAIL	15A	11.	REAR-HTR	20A
3.	–		12.	IGN	7.5A
4.	STOP	10A	13.	A/C	10A
5.	DEFOG	20A	14.	DIFF	20A
6.	WIPER	20A	15.	–	
7.	GAUGE	10A	16.	HEATER	30A
8.	TURN	7.5A	17.	POWER	30A
9.	ECU-IG	15A	18.	Spear	
			19.	Spear	

86826gh3

Fig. 110 Fuse and circuit breaker locations — 1991 Land Cruiser

Relay Block No. 1 (Cowl Side)



Relay

A. Cooling Fan Relay
8. Blower Hi Relay
C. –
D. Defogger Relay
E. Power Main Relay
F. Turn Signal Flasher
G. Heater Relay
H. Taillight Control Relay
I. –
J. Circuit Opening Relay

86826gh6

Fig. 111 Fuse and circuit breaker locations — 1991 Land Cruiser

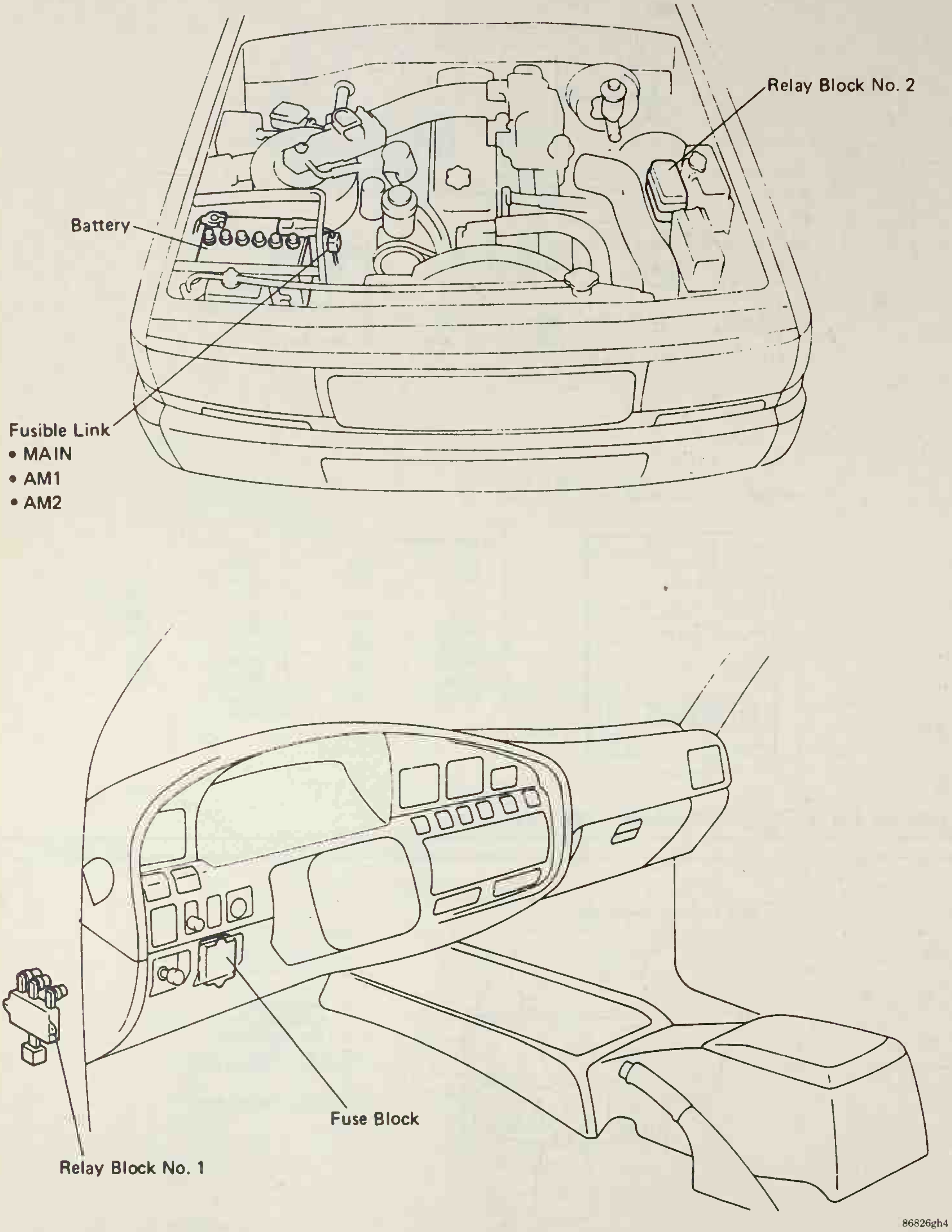
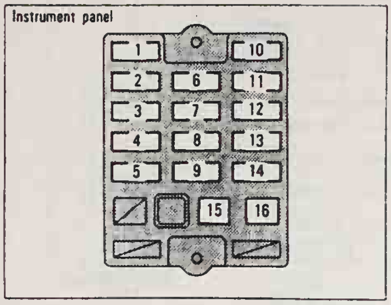

Relay Block No. 2
Battery
Fusible Link
• MAIN
• AM1
• AM2
Fuse Block
Relay Block No. 1
86826gh4

Fig. 112 Fuse and circuit breaker locations — 1991 Land Cruiser

Fuses



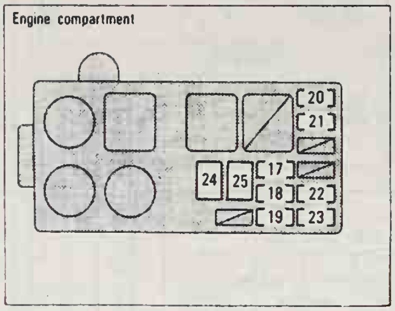
1. **CIG 15 A:** Cigarette lighter, power rear view mirrors, digital clock display, radio, cassette tape player, power antenna, automatic transmission shift lock system

2. **TAIL 15 A:** Tail lights, license plate lights, parking and front side marker lights, instrument panel lights, clock, glovebox light

3. **FOG 15 A:** No circuit

4. **STOP 10 A:** Stop lights, multiport fuel injection system/sequential multiport fuel injection system, cruise control cancel device, automatic transmission shift lock system

5. **DEFOG 20 A:** Rear window deffoger



6. **WIPER 20 A:** Windshield wipers and washer, rear window wiper and washer

7. **GAUGE 10 A:** Gauges and meters, service reminder indicators and warning buzzers (except discharge and open door warning lights), back-up lights

8. **TURN 7.5 A:** Turn signal lights

9. **ECU-IG 15 A:** Cruise control system

10. **ECU-B 10 A:** No circuit

11. **REAR-HTR 20 A:** Air conditioning system

12. **IGN 7.5 A:** Multiport fuel injection system/sequential multiport fuel injection system, emission control system

13. **A.C 10 A:** Air conditioning system

14. **DIFF 30 A:** Differential lock system

15. **FL HEATER 30 A:** Air conditioning system

16. **FL POWER 30 A:** Power windows, power door lock system, electric moon roof

17. **CHARGE 7.5 A:** Charging system, discharge warning light

18. **EFI 15 A:** Multiport fuel injection system/sequential multiport fuel injection system

19. **CDS-FAN 20 A:** Electric cooling fan

20. **HEAD (RH) 15 A:** Right-hand headlights

21. **HEAD (LH) 15 A:** Left-hand headlights

22. **HAZ-HORN 15 A:** Emergency flashers, horns

23. **DOME 10 A:** Interior lights, personal light, luggage compartment light, ignition switch light, open door warning light, clock, radio, cassette tape player, power antenna, vanity lights

24. **AM 1 50 A:** All components in "CIG", "WIPER", "GAUGE", "TURN", "ECU-IG", "REAR-HTR", "IGN", "DIFF" and "FL POWER" circuits

25. **ABS 60 A:** Anti-lock brake system

86826gh7

Fig. 113 Fuse and circuit breaker locations — 1992-95 Land Cruiser

WIRING DIAGRAMS

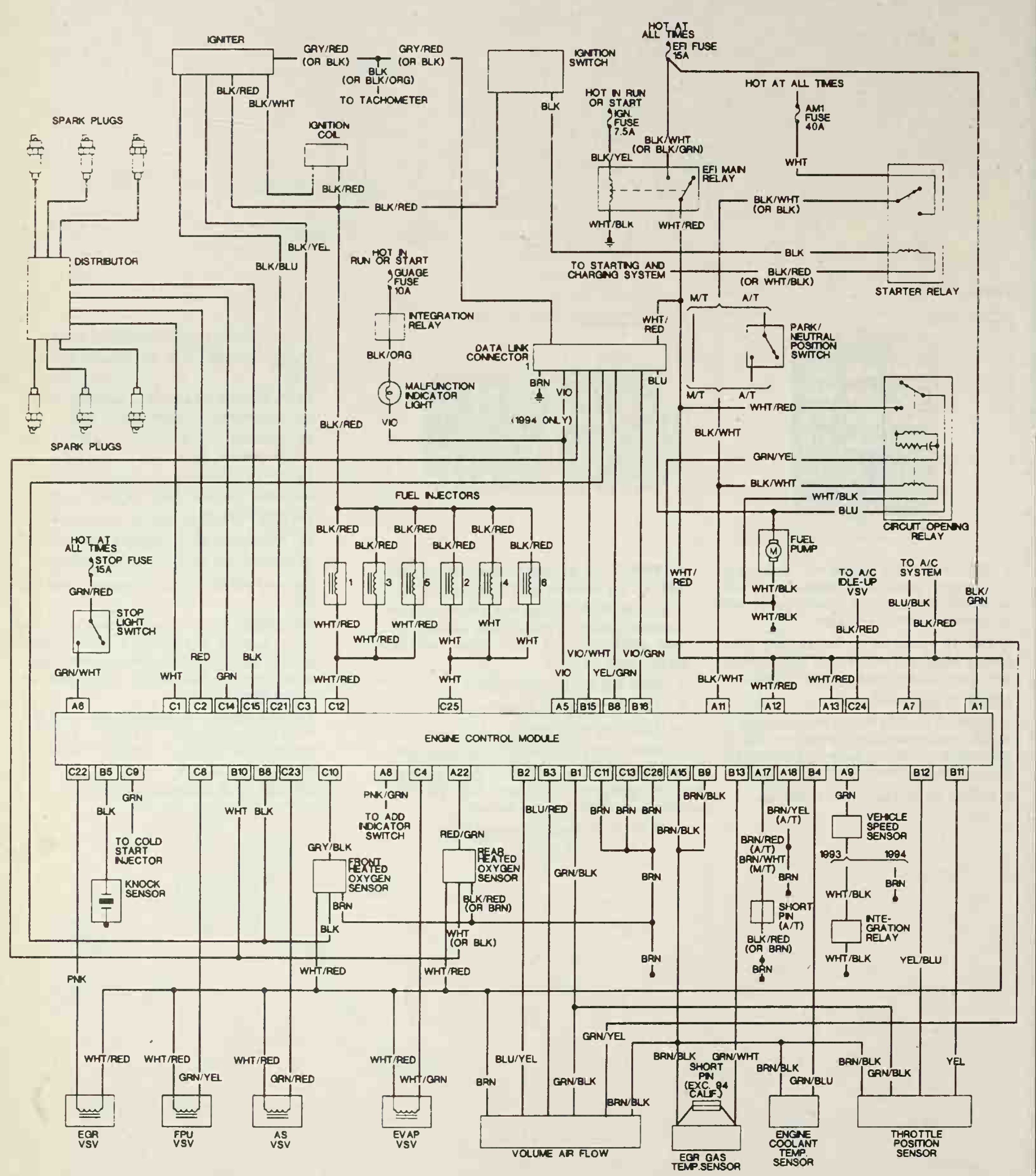
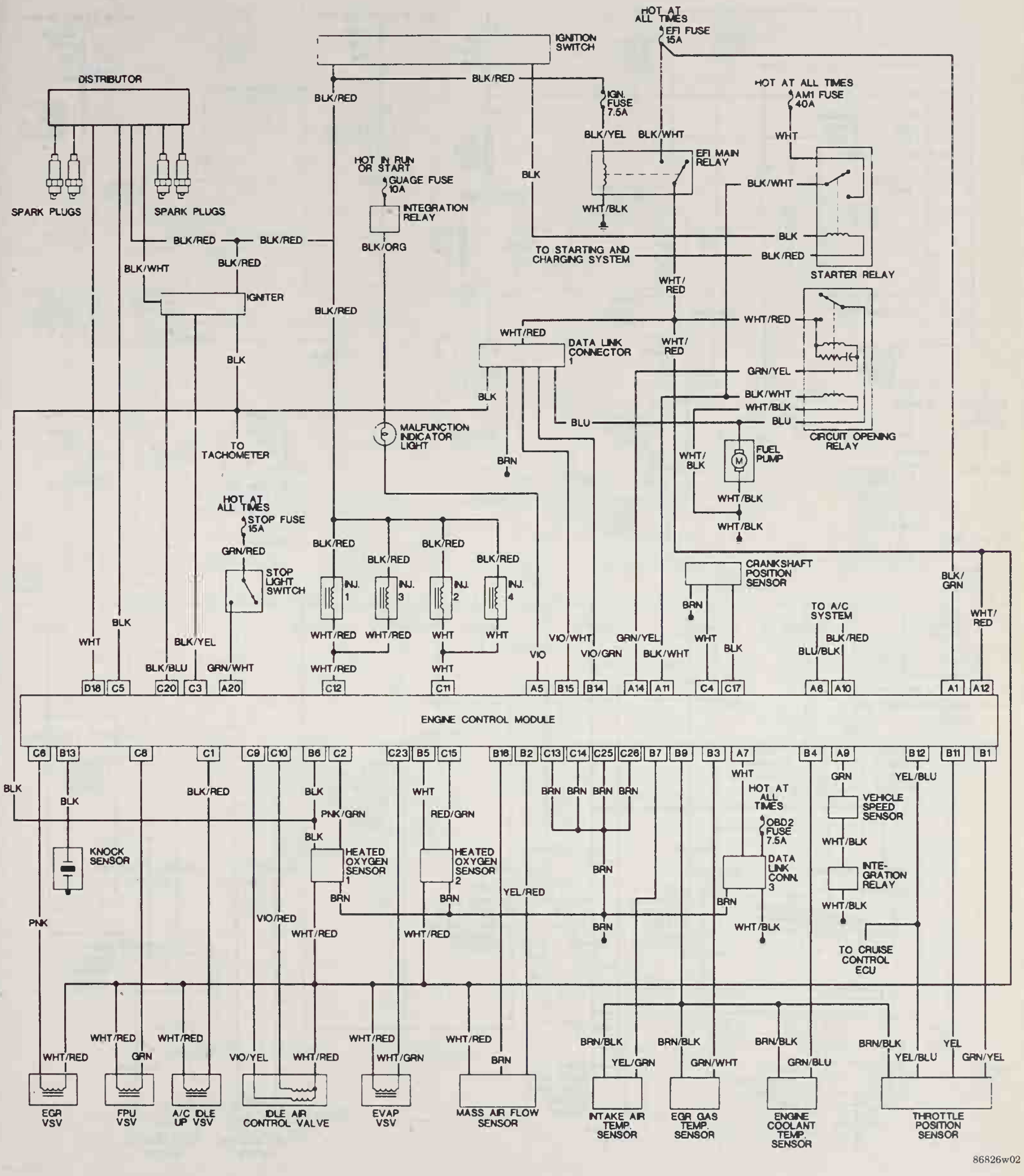

IGNITER
GRY/RED (OR BLK)
GRY/RED (OR BLK)
BLK (OR BLK/ORG)
TO TACHOMETER
BLK/RED
BLK/WHT
SPARK PLUGS
IGNITION COIL
BLK/RED
BLK/RED
IGNITION SWITCH
BLK
HOT AT ALL TIMES
EFI FUSE 15A
HOT IN RUN OR START
IGN. FUSE 7.5A
BLK/WHT (OR BLK/GRN)
BLK/YEL
EFI MAIN RELAY
WHT/BLK
WHT/RED
HOT AT ALL TIMES
AM1 FUSE 40A
WHT
BLK/WHT (OR BLK)
BLK
STARTER RELAY
TO STARTING AND CHARGING SYSTEM
BLK/RED (OR WHT/BLK)
DISTRIBUTOR
BLK/YEL
BLK/BLU
HOT IN RUN OR START
GUAGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
MALFUNCTION INDICATOR LIGHT
VIO
BLK/RED
DATA LINK CONNECTOR
1
BRN
VIO
(1994 ONLY)
WHT/RED
M/T
A/T
PARK/NEUTRAL POSITION SWITCH
BLU
M/T
A/T
WHT/RED
BLK/WHT
GRN/YEL
BLK/WHT
WHT/BLK
BLU
CIRCUIT OPENING RELAY
SPARK PLUGS
FUEL INJECTORS
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
1
3
5
2
4
6
WHT/RED
WHT/RED
WHT/RED
WHT
WHT
WHT
WHT/RED
WHT
FUEL PUMP
WHT/BLK
WHT/BLK
WHT/RED
TO A/C IDLE-UP VSV
TO A/C SYSTEM
BLU/BLK
BLK/RED
BLK/RED
BLK/GRN
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LIGHT SWITCH
GRN/WHT
WHT
RED
GRN
BLK
VIO/WHT
VIO/GRN
VIO
YEL/GRN
BLK/WHT
WHT/RED
WHT/RED
A6
C1
C2
C14
C15
C21
C3
C12
C25
A5
B15
B8
B16
A11
A12
A13
C24
A7
A1
ENGINE CONTROL MODULE
C22
B5
C9
C8
B10
B8
C23
C10
A8
C4
A22
B2
B3
B1
C11
C13
C26
A16
B9
B13
A17
A18
B4
A9
B12
B11
BLK
GRN
TO COLD START INJECTOR
KNOCK SENSOR
WHT
BLK
GRY/BLK
FRONT HEATED OXYGEN SENSOR
BRN
BLK
PNK/GRN
TO ADD INDICATOR SWITCH
RED/GRN
REAR HEATED OXYGEN SENSOR
BLK/RED (OR BRN)
WHT (OR BLK)
BLU/RED
BRN
BRN
BRN
GRN/BLK
BRN/BLK
BRN/BLK
BRN
BRN
BRN/BLK
BRN/YEL (A/T)
BRN/RED (A/T)
BRN/WHT (M/T)
BRN
SHORT PIN (A/T)
BLK/RED (OR BRN)
BRN
GRN
VEHICLE SPEED SENSOR
1993
1994
WHT/BLK
BRN
INTEGRATION RELAY
WHT/BLK
YEL/BLU
PNK
WHT/RED
WHT/RED
WHT/RED
WHT/RED
WHT/RED
WHT/RED
GRN/YEL
GRN/RED
WHT/GRN
GRN/YEL
BLU/YEL
BRN
GRN/BLK
BRN/BLK
BRN/BLK
GRN/WHT
SHORT PIN (EXC. 94 CALIF.)
BRN/BLK
GRN/BLU
BRN/BLK
GRN/BLK
YEL
EGR VSV
FPU VSV
AS VSV
EVAP VSV
VOLUME AIR FLOW
EGR GAS TEMP.SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826W01

Fig. 114 Engine wiring — T100 1993-94 3.0L


HOT AT ALL TIMES
EFI FUSE 15A
IGNITION SWITCH
DISTRIBUTOR
BLK/RED
IGN. FUSE 7.5A
HOT AT ALL TIMES
AM1 FUSE 40A
BLK/YEL
BLK/WHT
WHT
EFI MAIN RELAY
HOT IN RUN OR START
GUAGE FUSE 10A
BLK
BLK/WHT
INTEGRATION RELAY
WHT/BLK
SPARK PLUGS
SPARK PLUGS
BLK/RED
BLK/RED
TO STARTING AND CHARGING SYSTEM
BLK
BLK/RED
BLK/ORG
BLK/RED
STARTER RELAY
BLK/WHT
IGNITER
WHT/RED
BLK/RED
WHT/RED
WHT/RED
DATA LINK CONNECTOR 1
WHT/RED
BLK
GRN/YEL
BLK
BLK/WHT
WHT/BLK
BLU
BLU
TO TACHOMETER
MALFUNCTION INDICATOR LIGHT
CIRCUIT OPENING RELAY
BRN
WHT/BLK
FUEL PUMP
WHT/BLK
WHT/BLK
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
CRANKSHAFT POSITION SENSOR
STOP LIGHT SWITCH
INJ. 1
INJ. 3
INJ. 2
INJ. 4
BRN
BLK/GRN
TO A/C SYSTEM
WHT/RED
BLK
WHT
BLK/YEL
WHT/RED
WHT/RED
WHT
WHT
VIO/WHT
GRN/YEL
WHT
BLK
BLK/RED
BLU/BLK
BLK/BLU
GRN/WHT
WHT/RED
WHT
VIO
VIO/GRN
BLK/WHT
D18
C5
C20
C3
A20
C12
C11
A5
B15
B14
A14
A11
C4
C17
A6
A10
A1
A12
ENGINE CONTROL MODULE
C6
B13
C8
C1
C9
C10
B6
C2
C23
B5
C15
B16
B2
C13
C14
C25
C26
B7
B9
B3
A7
B4
A9
B12
B11
B1
BLK
BLK
BLK/RED
BLK
WHT
BRN
BRN
BRN
BRN
WHT
GRN
YEL/BLU
PNK/GRN
RED/GRN
HOT AT ALL TIMES
VEHICLE SPEED SENSOR
BLK
OBD2 FUSE 7.5A
KNOCK SENSOR
HEATED OXYGEN SENSOR 1
HEATED OXYGEN SENSOR 2
BRN
DATA LINK CONN. 3
WHT/BLK
INTE-GRATION RELAY
BRN
BRN
YEL/RED
BRN
WHT/BLK
PNK
VIO/RED
WHT/RED
WHT/RED
BRN
WHT/BLK
TO CRUISE CONTROL ECU
WHT/RED
WHT/RED
WHT/RED
WHT/RED
WHT/RED
GRN
VIO/YEL
WHT/RED
WHT/GRN
BRN
BRN/BLK
YEL/GRN
BRN/BLK
GRN/WHT
BRN/BLK
GRN/BLU
BRN/BLK
YEL
YEL/BLU
GRN/YEL
EGR VSV
FPU VSV
A/C IDLE UP VSV
IDLE AIR CONTROL VALVE
EVAP VSV
MASS AIR FLOW SENSOR
INTAKE AIR TEMP. SENSOR
EGR GAS TEMP. SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR

86826w02

Fig. 115 Engine wiring — T100 1994 2.7L

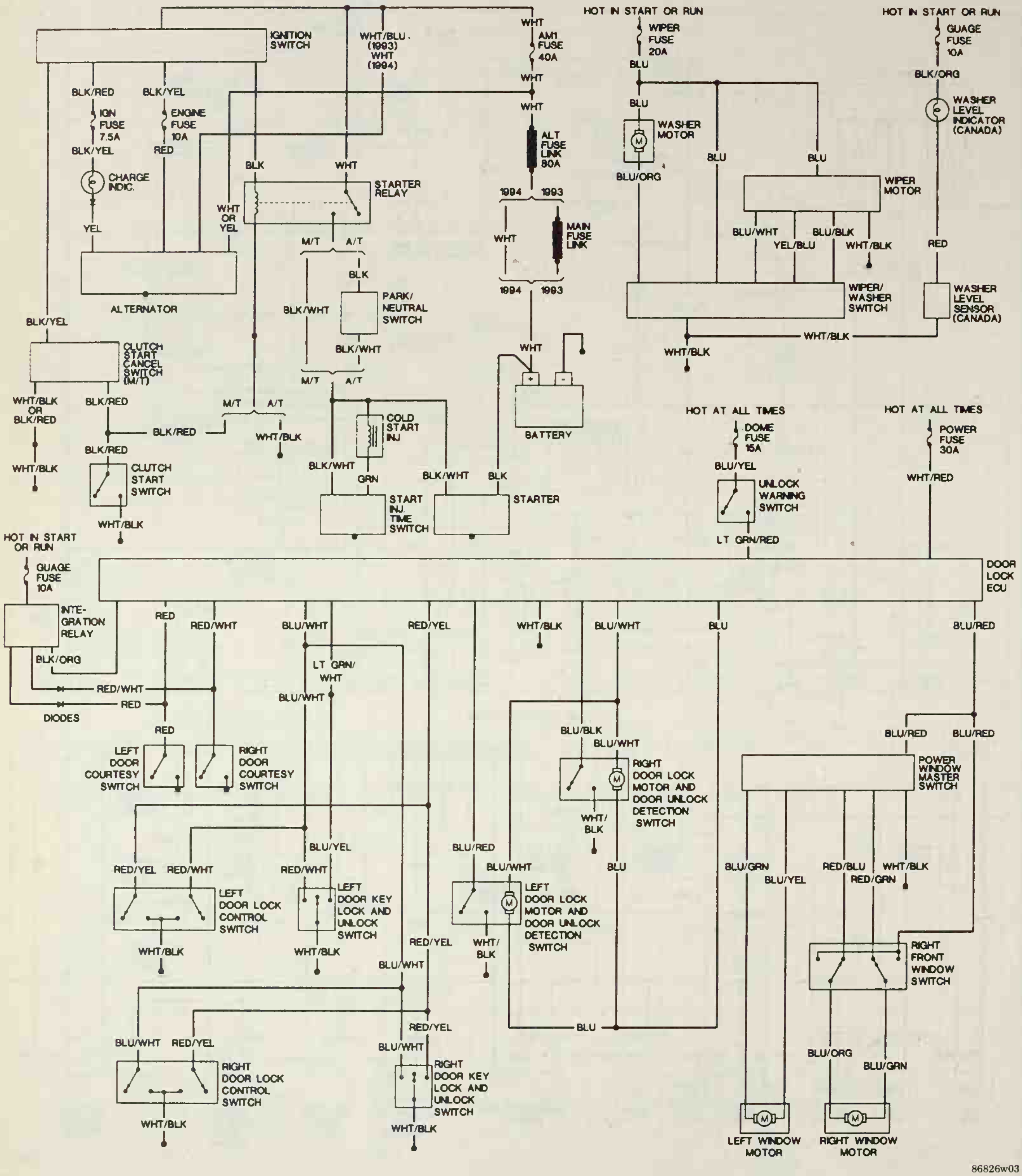
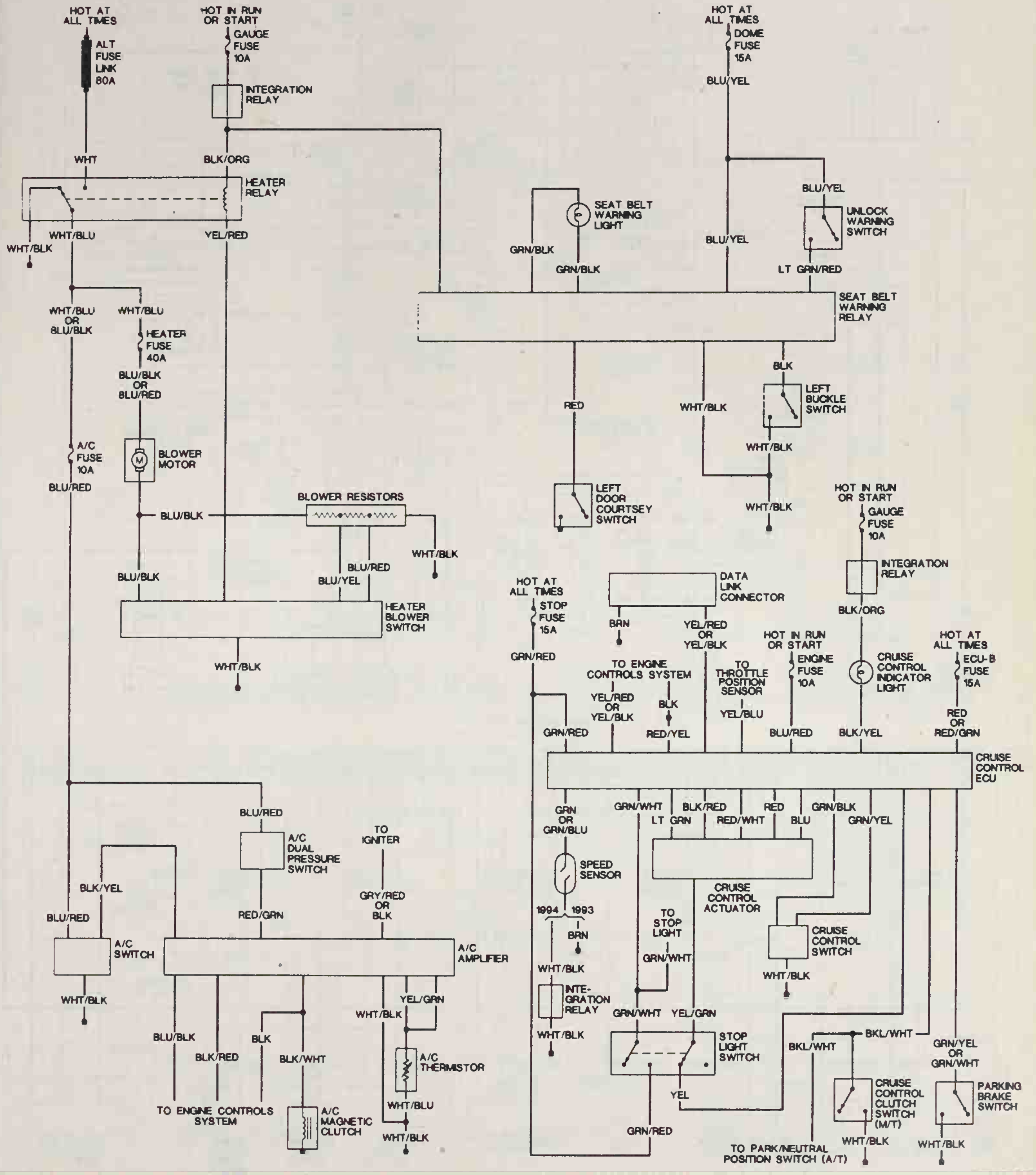

IGNITION SWITCH
WHT/BLU (1993) WHT (1994)
WHT
AM1 FUSE 40A
WHT
WHT
ALT FUSE LINK 80A
1994
1993
WHT
MAIN FUSE LINK
1994
1993
WHT
BATTERY
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
WASHER MOTOR
BLU/ORG
BLU
BLU
WIPER MOTOR
BLU/WHT
YEL/BLU
BLU/BLK
WHT/BLK
WIPER/ WASHER SWITCH
WHT/BLK
WHT/BLK
HOT IN START OR RUN
GUAGE FUSE 10A
BLK/ORG
WASHER LEVEL INDICATOR (CANADA)
RED
WASHER LEVEL SENSOR (CANADA)
BLK/RED
IGN FUSE 7.5A
BLK/YEL
BLK/YEL
ENGINE FUSE 10A
RED
CHARGE INDIC.
YEL
BLK
WHT
STARTER RELAY
WHT OR YEL
ALTERNATOR
M/T
A/T
BLK
PARK/ NEUTRAL SWITCH
BLK/WHT
BLK/WHT
M/T
A/T
BLK/YEL
CLUTCH START CANCEL SWITCH (M/T)
WHT/BLK OR BLK/RED
BLK/RED
WHT/BLK
BLK/RED
M/T
A/T
BLK/RED
WHT/BLK
CLUTCH START SWITCH
WHT/BLK
COLD START INJ
BLK/WHT
GRN
START INJ. TIME SWITCH
BLK/WHT
BLK
STARTER
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
LT GRN/RED
HOT AT ALL TIMES
POWER FUSE 30A
WHT/RED
DOOR LOCK ECU
HOT IN START OR RUN
GUAGE FUSE 10A
INTE-GRATION RELAY
BLK/ORG
RED/WHT
RED
DIODES
RED
RED/WHT
BLU/WHT
LT GRN/ WHT
BLU/WHT
RED/YEL
WHT/BLK
BLU/WHT
BLU
BLU/RED
RED
LEFT DOOR COURTESY SWITCH
RIGHT DOOR COURTESY SWITCH
BLU/BLK
BLU/WHT
RIGHT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
WHT/ BLK
BLU/RED
BLU/RED
POWER WINDOW MASTER SWITCH
RED/YEL
RED/WHT
LEFT DOOR LOCK CONTROL SWITCH
WHT/BLK
BLU/YEL
RED/WHT
LEFT DOOR KEY LOCK AND UNLOCK SWITCH
WHT/BLK
BLU/RED
BLU/WHT
LEFT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
WHT/ BLK
BLU
RED/YEL
BLU/WHT
BLU/GRN
BLU/YEL
RED/BLU
RED/GRN
WHT/BLK
RIGHT FRONT WINDOW SWITCH
BLU
RED/YEL
BLU/WHT
BLU/WHT
RED/YEL
RIGHT DOOR LOCK CONTROL SWITCH
WHT/BLK
RIGHT DOOR KEY LOCK AND UNLOCK SWITCH
WHT/BLK
BLU/ORG
BLU/GRN
LEFT WINDOW MOTOR
RIGHT WINDOW MOTOR
86826w03

Fig. 116 Chassis wiring — T100 1993-94


HOT AT ALL TIMES
ALT FUSE LINK 80A
HOT IN RUN OR START
GAUGE FUSE 10A
INTEGRATION RELAY
WHT
BLK/ORG
HEATER RELAY
WHT/BLU
WHT/BLK
YEL/RED
WHT/BLU OR BLU/BLK
WHT/BLU
HEATER FUSE 40A
BLU/BLK OR BLU/RED
A/C FUSE 10A
BLU/RED
BLOWER MOTOR
BLU/BLK
BLOWER RESISTORS
WHT/BLK
BLU/RED
BLU/YEL
BLU/BLK
HEATER BLOWER SWITCH
WHT/BLK
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
BLU/YEL
UNLOCK WARNING SWITCH
SEAT BELT WARNING LIGHT
GRN/BLK
GRN/BLK
BLU/YEL
LT GRN/RED
SEAT BELT WARNING RELAY
BLK
LEFT BUCKLE SWITCH
RED
WHT/BLK
WHT/BLK
WHT/BLK
LEFT DOOR COURTSEY SWITCH
HOT IN RUN OR START
GAUGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
DATA LINK CONNECTOR
BRN
YEL/RED OR YEL/BLK
TO ENGINE CONTROLS SYSTEM
YEL/RED OR YEL/BLK
BLK
RED/YEL
TO THROTTLE POSITION SENSOR
YEL/BLU
HOT IN RUN OR START
ENGINE FUSE 10A
BLU/RED
CRUISE CONTROL INDICATOR LIGHT
BLK/YEL
HOT AT ALL TIMES
ECU-B FUSE 15A
RED OR RED/GRN
GRN/RED
CRUISE CONTROL ECU
GRN OR GRN/BLU
GRN/WHT
LT GRN
BLK/RED
RED/WHT
RED
BLU
GRN/BLK
GRN/YEL
SPEED SENSOR
CRUISE CONTROL ACTUATOR
1994
1993
BRN
TO STOP LIGHT
GRN/WHT
CRUISE CONTROL SWITCH
WHT/BLK
WHT/BLK
INTE-GRATION RELAY
WHT/BLK
GRN/WHT
YEL/GRN
STOP LIGHT SWITCH
YEL
GRN/RED
BKL/WHT
BKL/WHT
CRUISE CONTROL CLUTCH SWITCH (M/T)
WHT/BLK
GRN/YEL OR GRN/WHT
PARKING BRAKE SWITCH
WHT/BLK
TO PARK/NEUTRAL POSITION SWITCH (A/T)
BLU/RED
A/C DUAL PRESSURE SWITCH
TO IGNITER
BLK/YEL
BLU/RED
RED/GRN
GRY/RED OR BLK
A/C SWITCH
A/C AMPLIFIER
WHT/BLK
YEL/GRN
WHT/BLK
BLU/BLK
BLK
BLK/RED
BLK/WHT
A/C THERMISTOR
TO ENGINE CONTROLS SYSTEM
A/C MAGNETIC CLUTCH
WHT/BLU
WHT/BLK

86826w04

Fig. 117 Chassis wiring — T100 1993-94 continued

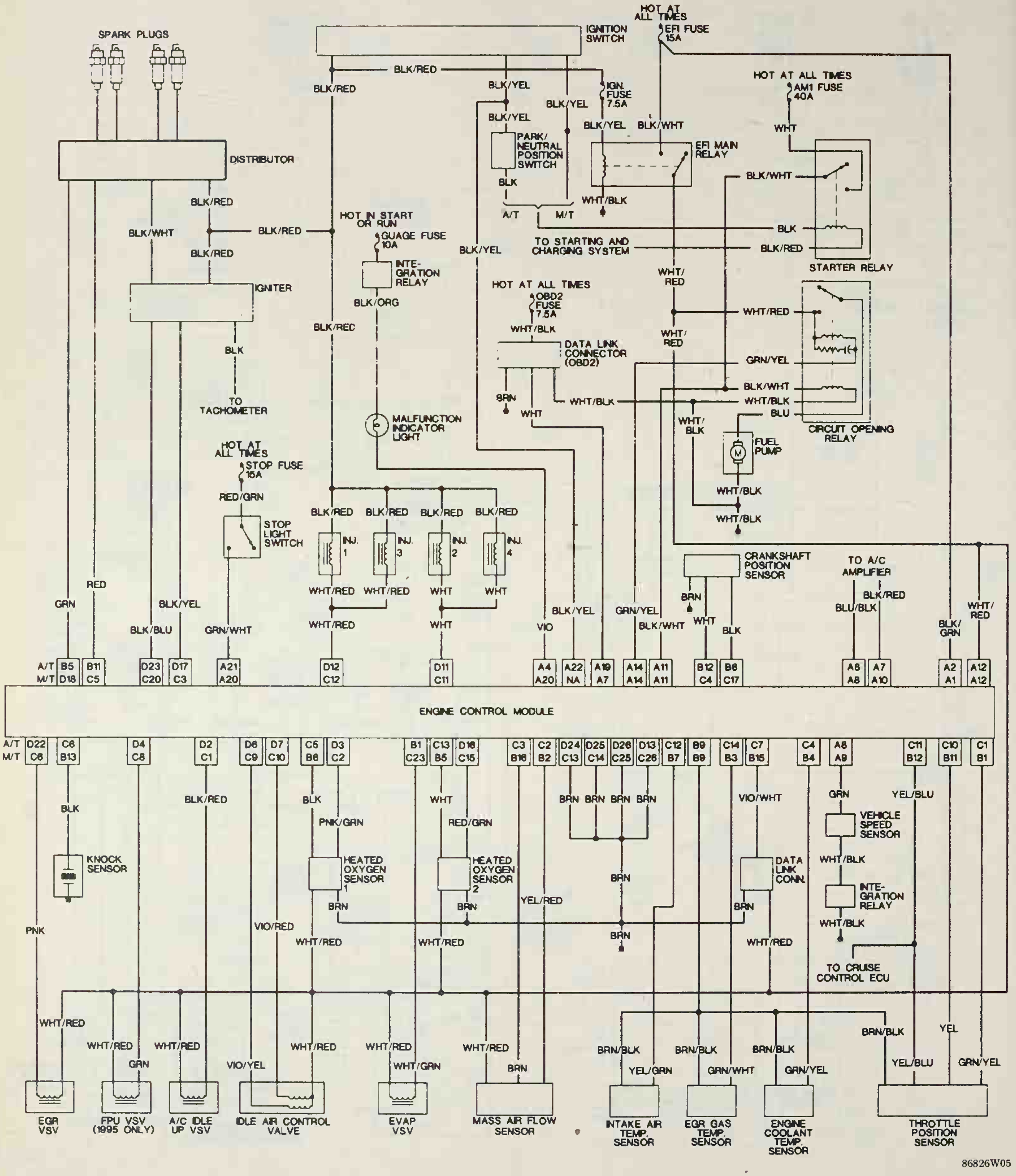

HOT AT ALL TIMES
EFI FUSE 15A
IGNITION SWITCH
SPARK PLUGS
BLK/RED
IGN. FUSE 7.5A
BLK/YEL
HOT AT ALL TIMES
AM1 FUSE 40A
WHT
PARK/ NEUTRAL POSITION SWITCH
BLK/WHT
EFI MAIN RELAY
DISTRIBUTOR
BLK
A/T
M/T
WHT/BLK
BLK/WHT
STARTER RELAY
TO STARTING AND CHARGING SYSTEM
HOT IN START OR RUN
GUAGE FUSE 10A
INTE-GRATION RELAY
BLK/ORG
IGNITER
HOT AT ALL TIMES
OBD2 FUSE 7.5A
WHT/BLK
DATA LINK CONNECTOR (OBD2)
WHT/RED
GRN/YEL
BRN
TO TACHOMETER
MALFUNCTION INDICATOR LIGHT
CIRCUIT OPENING RELAY
BLU
FUEL PUMP
HOT AT ALL TIMES
STOP FUSE 15A
RED/GRN
STOP LIGHT SWITCH
INJ. 1
INJ. 3
INJ. 2
INJ. 4
CRANKSHAFT POSITION SENSOR
TO A/C AMPLIFIER
BLU/BLK
GRN
RED
BLK/BLU
GRN/WHT
VIO
BLK/GRN
WHT/RED
A/T B5 B11 D23 D17 A21 D12 D11 A4 A22 A19 A14 A11 B12 B6 A6 A7 A2 A12
M/T D18 C5 C20 C3 A20 C12 C11 A20 NA A7 A14 A11 C4 C17 A6 A10 A1 A12
ENGINE CONTROL MODULE
A/T D22 C6 D4 D2 D6 D7 C5 D3 B1 C13 D16 C3 C2 D24 D25 D26 D13 C12 B9 C14 C7 C4 A8 C11 C10 C1
M/T C6 B13 C8 C1 C9 C10 B6 C2 C23 B5 C15 B16 B2 C13 C14 C25 C26 B7 B9 B3 B15 B4 A9 B12 B11 B1
KNOCK SENSOR
PNK/GRN
HEATED OXYGEN SENSOR 1
RED/GRN
HEATED OXYGEN SENSOR 2
YEL/RED
VIO/RED
VIO/WHT
DATA LINK CONN.
VEHICLE SPEED SENSOR
YEL/BLU
INTE-GRATION RELAY
TO CRUISE CONTROL ECU
PNK
VIO/YEL
WHT/GRN
BRN/BLK
YEL/GRN
YEL
EGR VSV
FPU VSV (1995 ONLY)
A/C IDLE UP VSV
IDLE AIR CONTROL VALVE
EVAP VSV
MASS AIR FLOW SENSOR
INTAKE AIR TEMP. SENSOR
EGR GAS TEMP. SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826W05

Fig. 118 Engine wiring — T100 1995-96 2.7L

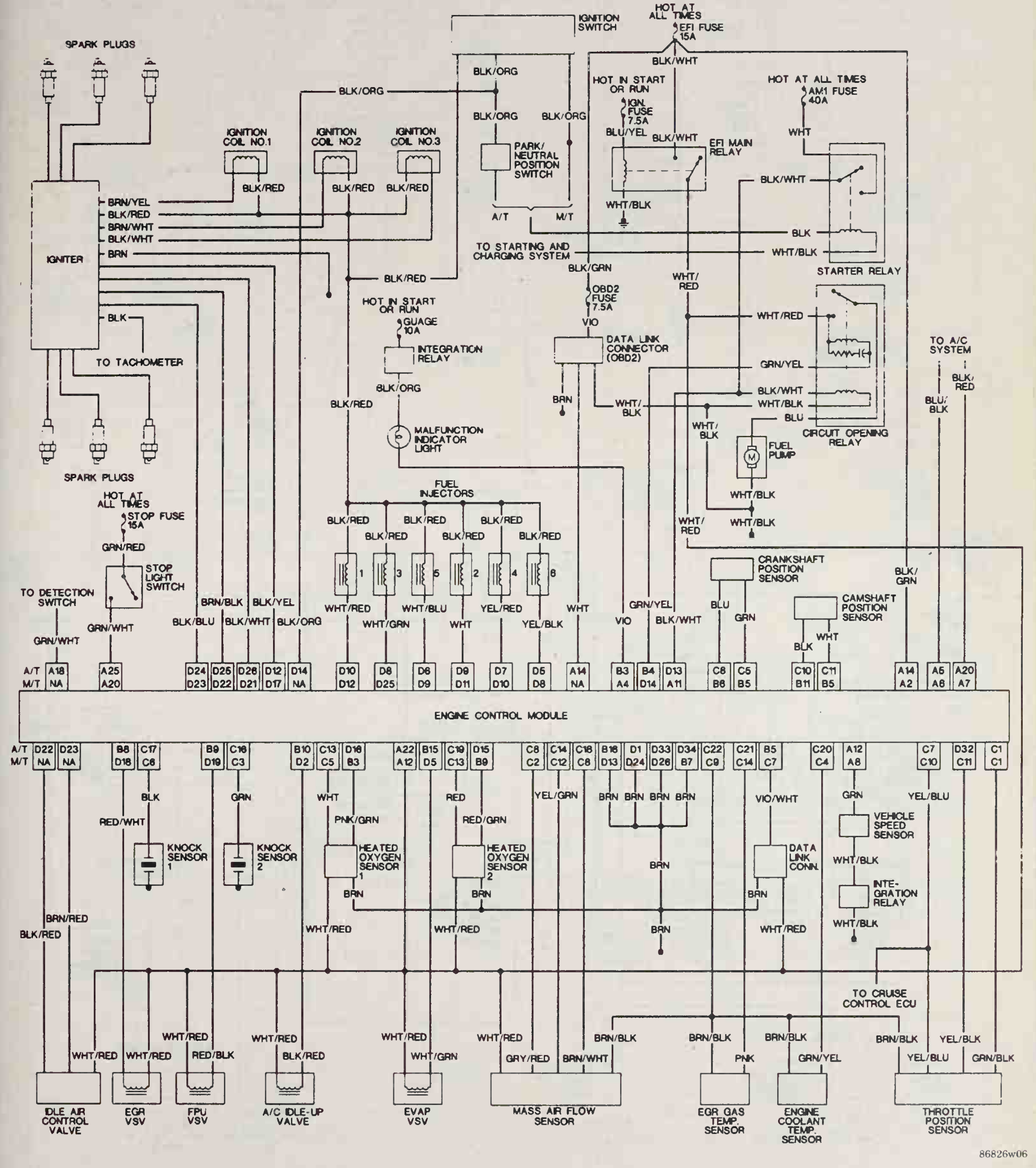
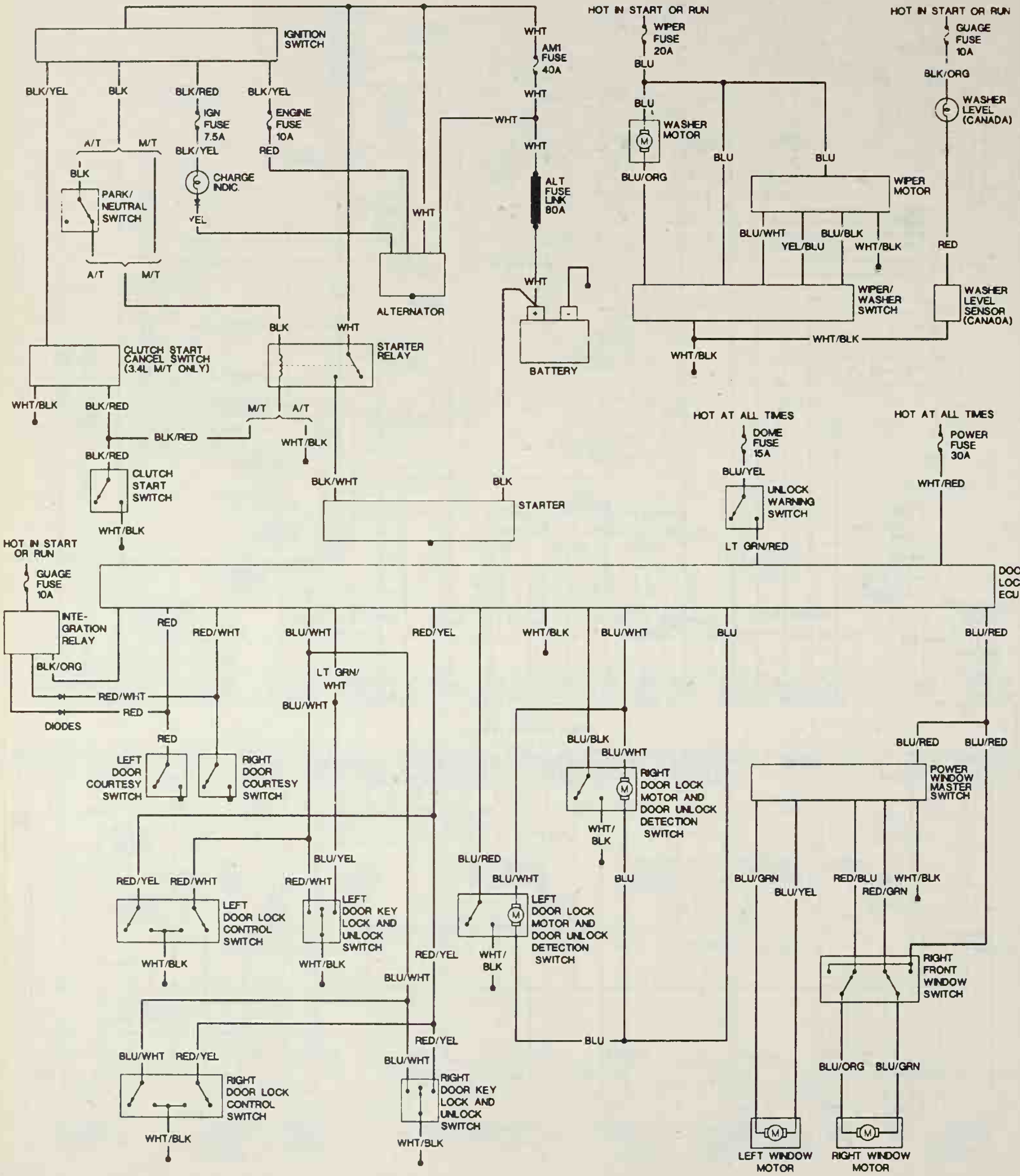

SPARK PLUGS
IGNITION SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
BLK/WHT
BLK/ORG
BLK/ORG
BLK/ORG
BLK/ORG
HOT IN START OR RUN
IGN. FUSE 7.5A
BLU/YEL
BLK/WHT
EFI MAIN RELAY
HOT AT ALL TIMES
AM1 FUSE 40A
WHT
IGNITION COIL NO.1
IGNITION COIL NO.2
IGNITION COIL NO.3
PARK/NEUTRAL POSITION SWITCH
BLK/RED
BLK/RED
BLK/RED
BRN/YEL
BLK/RED
BRN/WHT
BLK/WHT
BRN
IGNITER
A/T
M/T
WHT/BLK
BLK/WHT
BLK
WHT/BLK
TO STARTING AND CHARGING SYSTEM
STARTER RELAY
BLK/GRN
BLK/RED
HOT IN START OR RUN
GUAGE 10A
INTEGRATION RELAY
BLK/ORG
OBD2 FUSE 7.5A
VIO
DATA LINK CONNECTOR (OBD2)
WHT/RED
WHT/RED
BLK
TO TACHOMETER
GRN/YEL
BLK/WHT
WHT/BLK
BLU
TO A/C SYSTEM
BLK/RED
BLU/BLK
BLK/RED
BRN
WHT/BLK
MALFUNCTION INDICATOR LIGHT
WHT/BLK
CIRCUIT OPENING RELAY
FUEL PUMP
SPARK PLUGS
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
FUEL INJECTORS
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
1
3
5
2
4
6
WHT/BLK
WHT/RED
WHT/BLK
CRANKSHAFT POSITION SENSOR
STOP LIGHT SWITCH
TO DETECTION SWITCH
BRN/BLK
BLK/YEL
BLK/BLU
BLK/WHT
BLK/ORG
GRN/WHT
GRN/WHT
WHT/RED
WHT/GRN
WHT/BLU
WHT
YEL/RED
YEL/BLK
WHT
GRN/YEL
VIO
BLK/WHT
BLU
GRN
CAMSHAFT POSITION SENSOR
BLK
WHT
BLK/GRN
A/T
M/T
A18
NA
A25
A20
D24
D23
D25
D22
D26
D21
D12
D17
D14
NA
D10
D12
D8
D25
D6
D9
D9
D11
D7
D10
D5
D8
A14
NA
B3
A4
B4
D14
D13
A11
C8
B6
C5
B5
C10
B11
C11
B5
A14
A2
A5
A6
A20
A7
ENGINE CONTROL MODULE
A/T
M/T
D22
NA
D23
NA
B6
D18
C17
C6
B9
D19
C16
C3
B10
D2
C13
C5
D16
B3
A22
A12
B15
D5
C19
C13
D15
B9
C8
C2
C14
C12
C18
C8
B16
D13
D1
D24
D33
D26
D34
B7
C22
C9
C21
C14
B5
C7
C20
C4
A12
A6
C7
C10
D32
C11
C1
C1
BLK
RED/WHT
GRN
WHT
PNK/GRN
RED
RED/GRN
YEL/GRN
BRN
BRN
BRN
BRN
VIO/WHT
GRN
YEL/BLU
KNOCK SENSOR 1
KNOCK SENSOR 2
HEATED OXYGEN SENSOR 1
HEATED OXYGEN SENSOR 2
BRN
BRN
BRN
DATA LINK CONN.
BRN
VEHICLE SPEED SENSOR
WHT/BLK
INTE-GRATION RELAY
WHT/BLK
BRN/RED
BLK/RED
WHT/RED
WHT/RED
BRN
WHT/RED
TO CRUISE CONTROL ECU
WHT/RED
WHT/RED
WHT/RED
WHT/RED
RED/BLK
WHT/RED
BLK/RED
WHT/RED
WHT/GRN
WHT/RED
GRY/RED
BRN/WHT
BRN/BLK
BRN/BLK
PNK
BRN/BLK
GRN/YEL
BRN/BLK
YEL/BLK
YEL/BLU
GRN/BLK
IDLE AIR CONTROL VALVE
EGR VSV
FPU VSV
A/C IDLE-UP VALVE
EVAP VSV
MASS AIR FLOW SENSOR
EGR GAS TEMP. SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w06

Fig. 119 Engine wiring — T100 1995-96 3.0L


IGNITION SWITCH
BLK/YEL
BLK
BLK/RED
BLK/YEL
IGN FUSE 7.5A
ENGINE FUSE 10A
BLK/YEL
RED
A/T
M/T
BLK
PARK/ NEUTRAL SWITCH
CHARGE INDIC.
YEL
A/T
M/T
WHT
AM1 FUSE 40A
WHT
WHT
WHT
ALT FUSE LINK 80A
WHT
ALTERNATOR
WHT
BATTERY
BLK
WHT
STARTER RELAY
CLUTCH START CANCEL SWITCH (3.4L M/T ONLY)
WHT/BLK
BLK/RED
M/T
A/T
BLK/RED
WHT/BLK
BLK/RED
CLUTCH START SWITCH
WHT/BLK
BLK/WHT
BLK
STARTER
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
WASHER MOTOR
BLU/ORG
BLU
BLU
WIPER MOTOR
BLU/WHT
BLU/BLK
YEL/BLU
WHT/BLK
WIPER/ WASHER SWITCH
WHT/BLK
WHT/BLK
HOT IN START OR RUN
GUAGE FUSE 10A
BLK/ORG
WASHER LEVEL (CANADA)
RED
WASHER LEVEL SENSOR (CANADA)
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
LT GRN/RED
HOT AT ALL TIMES
POWER FUSE 30A
WHT/RED
DOOR LOCK ECU
HOT IN START OR RUN
GUAGE FUSE 10A
INTE- GRATION RELAY
BLK/ORG
RED
RED/WHT
BLU/WHT
RED/YEL
WHT/BLK
BLU/WHT
BLU
BLU/RED
LT GRN/ WHT
BLU/WHT
RED/WHT
RED
DIODES
RED
LEFT DOOR COURTESY SWITCH
RIGHT DOOR COURTESY SWITCH
BLU/BLK
BLU/WHT
RIGHT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
WHT/ BLK
BLU/YEL
BLU/RED
BLU/WHT
BLU
RED/YEL
RED/WHT
LEFT DOOR LOCK CONTROL SWITCH
WHT/BLK
RED/WHT
LEFT DOOR KEY LOCK AND UNLOCK SWITCH
WHT/BLK
LEFT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
RED/YEL
WHT/ BLK
BLU/WHT
BLU
RED/YEL
BLU/WHT
RED/YEL
BLU/WHT
RIGHT DOOR LOCK CONTROL SWITCH
WHT/BLK
RIGHT DOOR KEY LOCK AND UNLOCK SWITCH
WHT/BLK
BLU/RED
BLU/RED
POWER WINDOW MASTER SWITCH
BLU/GRN
BLU/YEL
RED/BLU
WHT/BLK
RED/GRN
RIGHT FRONT WINDOW SWITCH
BLU/ORG
BLU/GRN
LEFT WINDOW MOTOR
RIGHT WINDOW MOTOR

86826w07

Fig. 120 Chassis wiring — T100 1995-96

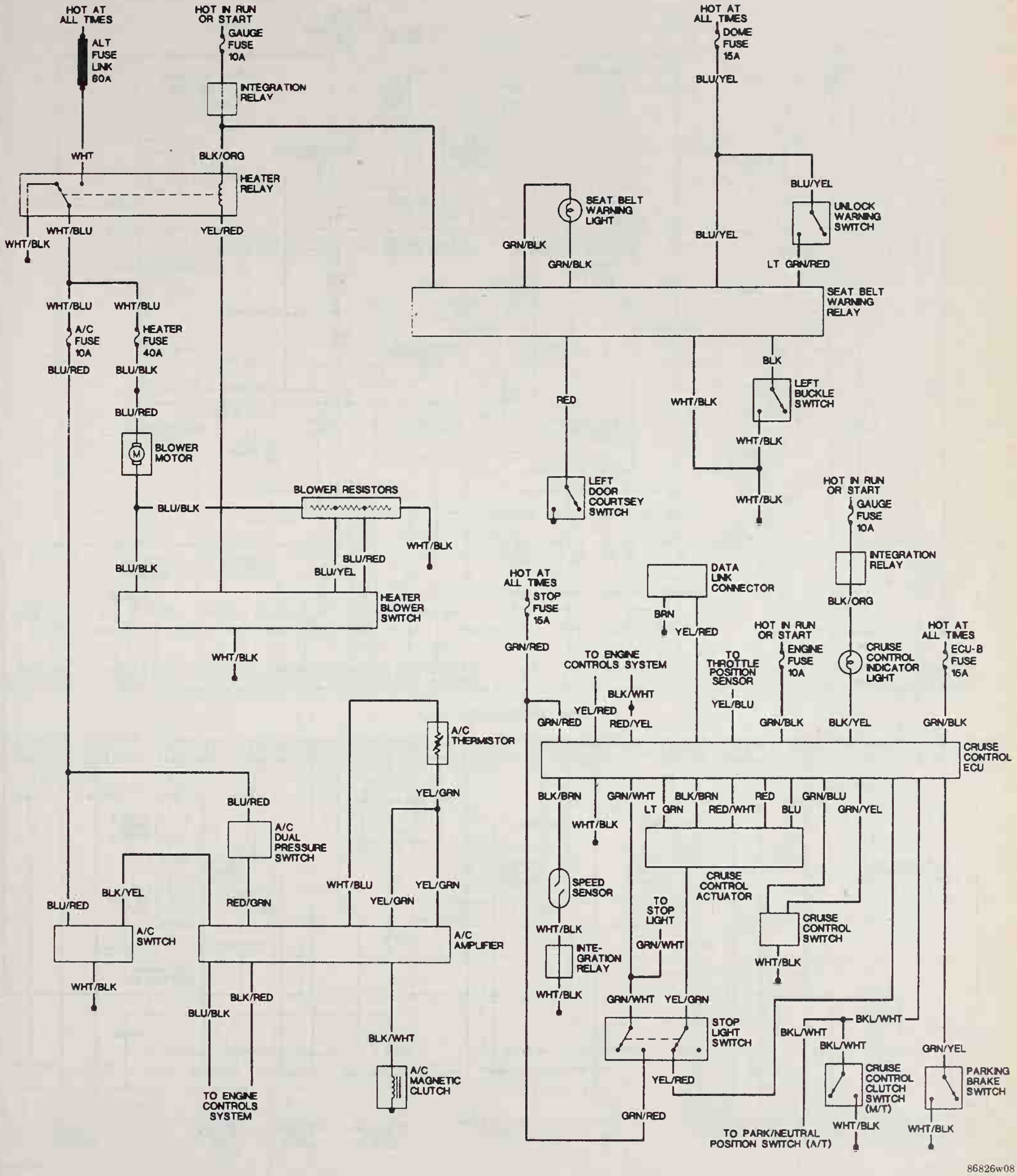

HOT AT ALL TIMES
ALT FUSE LINK 80A
HOT IN RUN OR START
GAUGE FUSE 10A
INTEGRATION RELAY
WHT
BLK/ORG
HEATER RELAY
WHT/BLK
WHT/BLU
YEL/RED
WHT/BLU
WHT/BLU
A/C FUSE 10A
HEATER FUSE 40A
BLU/RED
BLU/BLK
BLU/RED
BLOWER MOTOR
BLU/BLK
BLOWER RESISTORS
WHT/BLK
BLU/RED
BLU/YEL
BLU/BLK
HEATER BLOWER SWITCH
WHT/BLK
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
BLU/YEL
UNLOCK WARNING SWITCH
SEAT BELT WARNING LIGHT
GRN/BLK
GRN/BLK
BLU/YEL
LT GRN/RED
SEAT BELT WARNING RELAY
BLK
LEFT BUCKLE SWITCH
RED
WHT/BLK
WHT/BLK
LEFT DOOR COURTSEY SWITCH
WHT/BLK
HOT IN RUN OR START
GAUGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
DATA LINK CONNECTOR
BRN
YEL/RED
TO ENGINE CONTROLS SYSTEM
BLK/WHT
YEL/RED
GRN/RED
RED/YEL
TO THROTTLE POSITION SENSOR
YEL/BLU
HOT IN RUN OR START
ENGINE FUSE 10A
GRN/BLK
CRUISE CONTROL INDICATOR LIGHT
BLK/YEL
HOT AT ALL TIMES
ECU-B FUSE 15A
GRN/BLK
CRUISE CONTROL ECU
BLK/BRN
GRN/WHT
LT GRN
BLK/BRN
RED/WHT
RED
BLU
GRN/BLU
GRN/YEL
WHT/BLK
SPEED SENSOR
CRUISE CONTROL ACTUATOR
TO STOP LIGHT
CRUISE CONTROL SWITCH
WHT/BLK
INTE-GRATION RELAY
WHT/BLK
GRN/WHT
WHT/BLK
GRN/WHT
YEL/GRN
STOP LIGHT SWITCH
BKL/WHT
BKL/WHT
BKL/WHT
YEL/RED
GRN/RED
CRUISE CONTROL CLUTCH SWITCH (M/T)
GRN/YEL
PARKING BRAKE SWITCH
TO PARK/NEUTRAL POSITION SWITCH (A/T)
WHT/BLK
WHT/BLK
A/C THERMISTOR
YEL/GRN
BLU/RED
A/C DUAL PRESSURE SWITCH
BLK/YEL
BLU/RED
A/C SWITCH
WHT/BLK
RED/GRN
WHT/BLU
YEL/GRN
YEL/GRN
A/C AMPLIFIER
BLU/BLK
BLK/RED
TO ENGINE CONTROLS SYSTEM
BLK/WHT
A/C MAGNETIC CLUTCH
86826w08

Fig. 121 Chassis wiring — T100 1995-96 continued

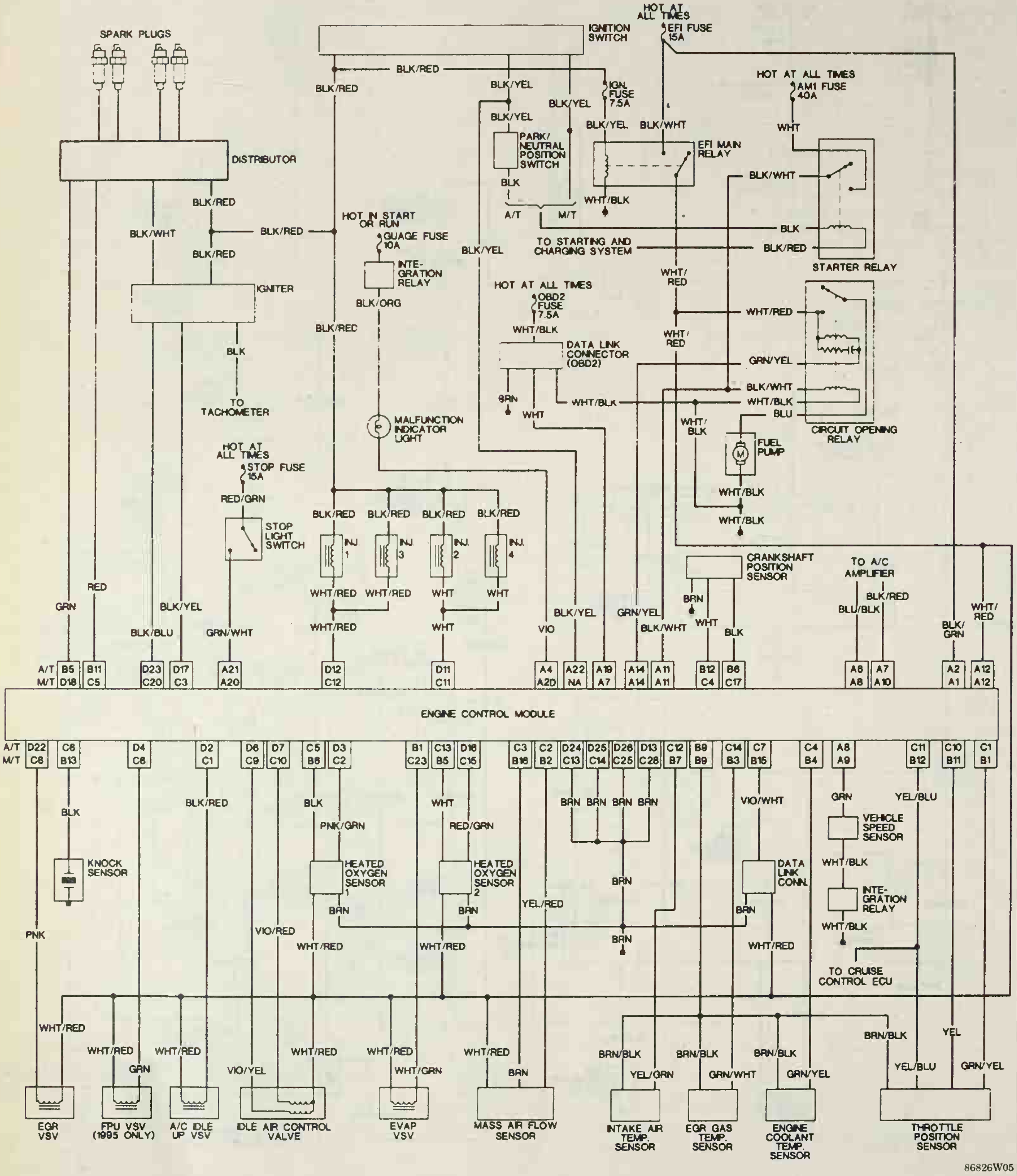
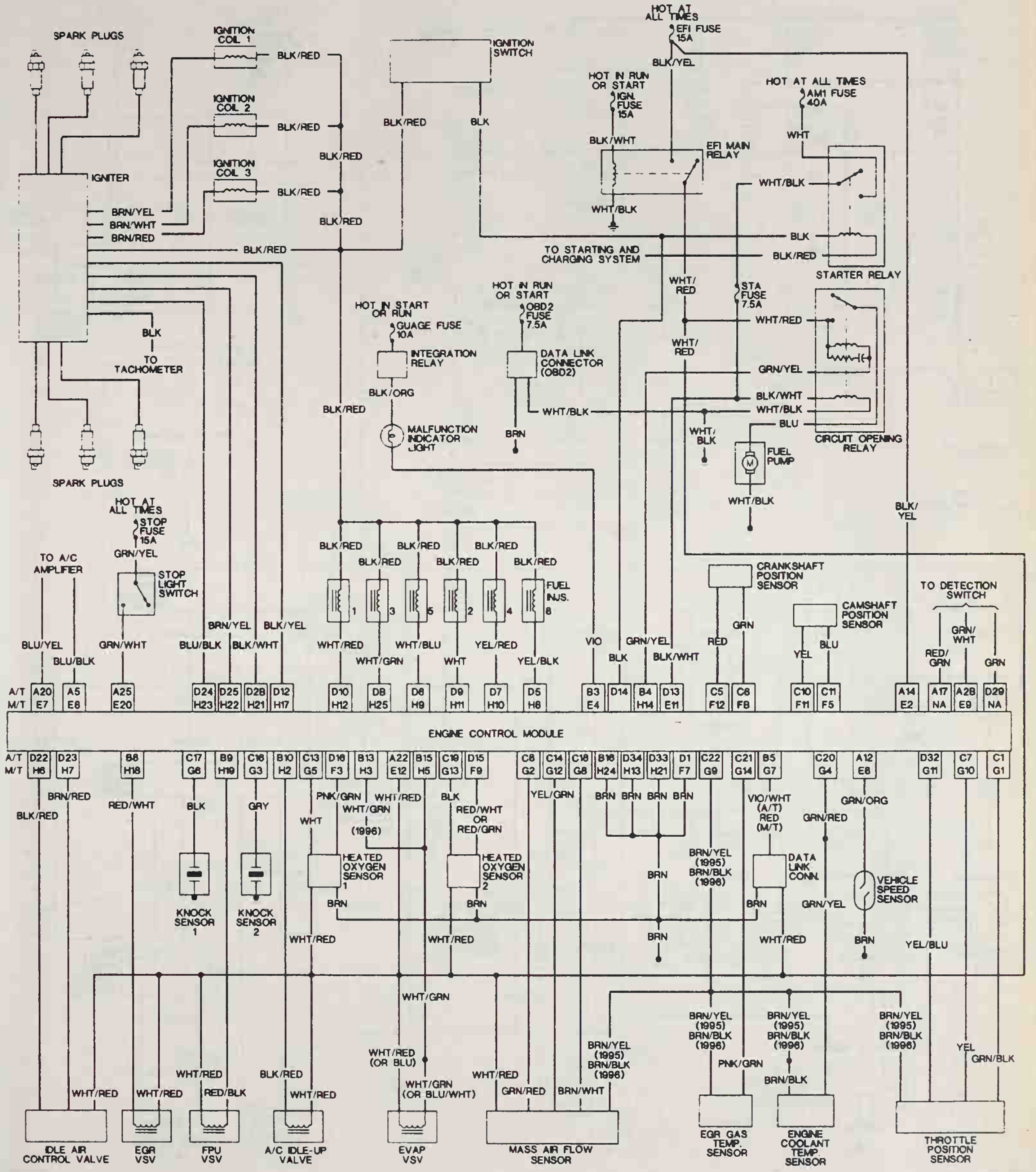

SPARK PLUGS
DISTRIBUTOR
IGNITER
TO TACHOMETER
IGNITION SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
IGN. FUSE 7.5A
PARK/NEUTRAL POSITION SWITCH
A/T
M/T
EFI MAIN RELAY
HOT AT ALL TIMES
AM1 FUSE 40A
STARTER RELAY
TO STARTING AND CHARGING SYSTEM
HOT IN START OR RUN
GUAGE FUSE 10A
INTE-GRATION RELAY
HOT AT ALL TIMES
OBD2 FUSE 7.5A
DATA LINK CONNECTOR (OBD2)
CIRCUIT OPENING RELAY
FUEL PUMP
MALFUNCTION INDICATOR LIGHT
HOT AT ALL TIMES
STOP FUSE 15A
STOP LIGHT SWITCH
INJ. 1
INJ. 3
INJ. 2
INJ. 4
CRANKSHAFT POSITION SENSOR
TO A/C AMPLIFIER
BLK/RED
BLK/YEL
BLK/WHT
WHT/BLK
BLK
WHT/RED
GRN/YEL
BLU
RED/GRN
BLK/ORG
GRN
RED
BLK/BLU
GRN/WHT
WHT
VIO
BRN
BLU/BLK
BLK/GRN
A/T M/T
B5 D18
B11 C5
D23 C20
D17 C3
A21 A20
D12 C12
D11 C11
A4 A20
A22 NA
A19 A7
A14 A14
A11 A11
B12 C4
B6 C17
A8 A8
A7 A10
A2 A1
A12 A12
ENGINE CONTROL MODULE
D22 C8
C8 B13
D4 C6
D2 C1
D6 C9
D7 C10
C5 B6
D3 C2
B1 C23
C13 B5
D16 C15
C3 B16
C2 B2
D24 C13
D25 C14
D26 C25
D13 C26
C12 B7
B9 B9
C14 B3
C7 B15
C4 B4
A8 A9
C11 B12
C10 B11
C1 B1
KNOCK SENSOR
PNK
PNK/GRN
HEATED OXYGEN SENSOR 1
RED/GRN
HEATED OXYGEN SENSOR 2
YEL/RED
VIO/RED
VIO/WHT
DATA LINK CONN.
VEHICLE SPEED SENSOR
YEL/BLU
INTE-GRATION RELAY
TO CRUISE CONTROL ECU
VIO/YEL
WHT/GRN
BRN/BLK
YEL/GRN
GRN/WHT
YEL
EGR VSV
FPU VSV (1995 ONLY)
A/C IDLE UP VSV
IDLE AIR CONTROL VALVE
EVAP VSV
MASS AIR FLOW SENSOR
INTAKE AIR TEMP. SENSOR
EGR GAS TEMP. SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826W05

Fig. 122 Engine wiring — Tacoma 1995-96 2.4 and 2.7L


SPARK PLUGS
IGNITION COIL 1
BLK/RED
IGNITION COIL 2
BLK/RED
IGNITION COIL 3
BLK/RED
IGNITER
BRN/YEL
BRN/WHT
BRN/RED
BLK/RED
IGNITION SWITCH
BLK/RED
BLK
HOT AT ALL TIMES
EFI FUSE 15A
BLK/YEL
HOT IN RUN OR START
IGN. FUSE 15A
BLK/WHT
EFI MAIN RELAY
WHT/BLK
HOT AT ALL TIMES
AM1 FUSE 40A
WHT
WHT/BLK
BLK
TO STARTING AND CHARGING SYSTEM
BLK/RED
STARTER RELAY
WHT/RED
STA FUSE 7.5A
WHT/RED
WHT/RED
GRN/YEL
BLK/WHT
WHT/BLK
BLU
CIRCUIT OPENING RELAY
WHT/BLK
FUEL PUMP
WHT/BLK
BLK
TO TACHOMETER
HOT IN START OR RUN
GUAGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
BLK/RED
MALFUNCTION INDICATOR LIGHT
HOT IN RUN OR START
OBD2 FUSE 7.5A
DATA LINK CONNECTOR (OBD2)
WHT/BLK
BRN
SPARK PLUGS
HOT AT ALL TIMES
STOP FUSE 15A
GRN/YEL
TO A/C AMPLIFIER
STOP LIGHT SWITCH
BLU/YEL
BLU/BLK
GRN/WHT
BRN/YEL
BLK/YEL
BLU/BLK
BLK/WHT
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
FUEL INJS.
1 3 5 2 4 6
WHT/RED
WHT/GRN
WHT/BLU
WHT
YEL/RED
YEL/BLK
VIO
BLK
GRN/YEL
BLK/WHT
CRANKSHAFT POSITION SENSOR
RED
GRN
CAMSHAFT POSITION SENSOR
YEL
BLU
BLK/YEL
TO DETECTION SWITCH
RED/GRN
GRN/WHT
GRN
A/T A20 A5 A25 D24 D25 D28 D12 D10 D8 D6 D9 D7 D5 B3 D14 B4 D13 C5 C6 C10 C11 A14 A17 A28 D29
M/T E7 E8 E20 H23 H22 H21 H17 H12 H25 H9 H11 H10 H8 E4 H14 E11 F12 F8 F11 F5 E2 NA E9 NA
ENGINE CONTROL MODULE
A/T D22 D23 B8 C17 B9 C16 B10 C13 D16 B13 A22 B15 C19 D15 C8 C14 C18 B16 D34 D33 D1 C22 C21 B5 C20 A12 D32 C7 C1
M/T H6 H7 H18 G6 H19 G3 H2 G5 F3 H3 E12 H5 G13 F9 G2 G12 G8 H24 H13 H21 F7 G9 G14 G7 G4 E6 G11 G10 G1
BRN/RED
BLK/RED
RED/WHT
BLK
GRY
PNK/GRN
WHT/RED
WHT/GRN
WHT
(1996)
BLK
RED/WHT OR RED/GRN
YEL/GRN
BRN BRN BRN BRN
VIO/WHT (A/T) RED (M/T)
GRN/RED
GRN/ORG
KNOCK SENSOR 1
KNOCK SENSOR 2
HEATED OXYGEN SENSOR 1
BRN
HEATED OXYGEN SENSOR 2
BRN
BRN
BRN/YEL (1995) BRN/BLK (1996)
DATA LINK CONN.
BRN
GRN/YEL
VEHICLE SPEED SENSOR
BRN
WHT/RED
WHT/RED
BRN
WHT/RED
YEL/BLU
WHT/GRN
BRN/YEL (1995) BRN/BLK (1996)
BRN/YEL (1995) BRN/BLK (1996)
BRN/YEL (1995) BRN/BLK (1996)
BRN/YEL (1995) BRN/BLK (1996)
PNK/GRN
BRN/BLK
YEL
GRN/BLK
WHT/RED (OR BLU)
WHT/GRN (OR BLU/WHT)
WHT/RED
WHT/RED
BLK/RED
WHT/RED
WHT/RED
RED/BLK
WHT/RED
GRN/RED
BRN/WHT
IDLE AIR CONTROL VALVE
EGR VSV
FPU VSV
A/C IDLE-UP VALVE
EVAP VSV
MASS AIR FLOW SENSOR
EGR GAS TEMP. SENSOR
ENGINE COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR

86826w10

Fig. 123 Engine wiring — Tacoma 1995-96 3.4L

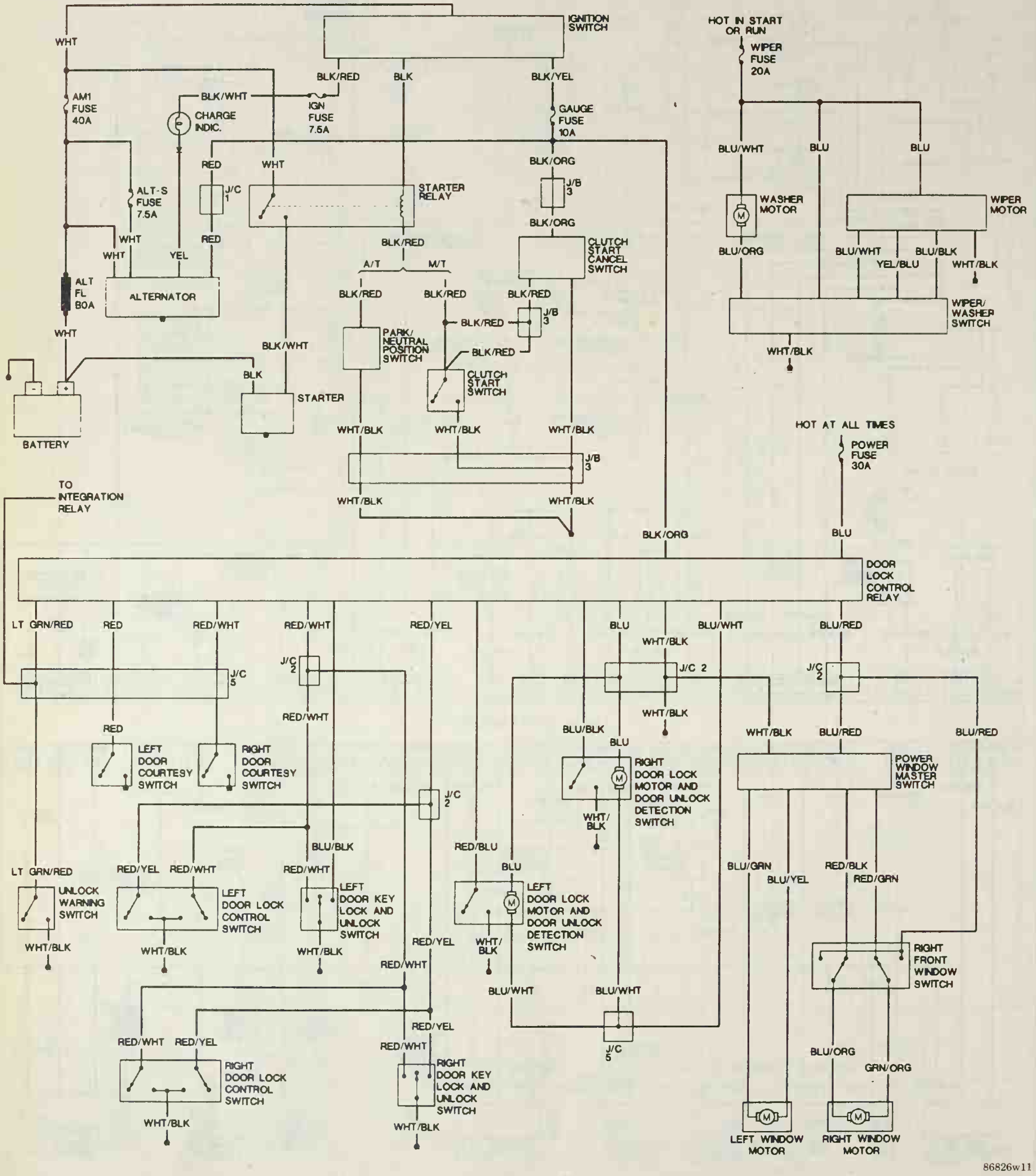
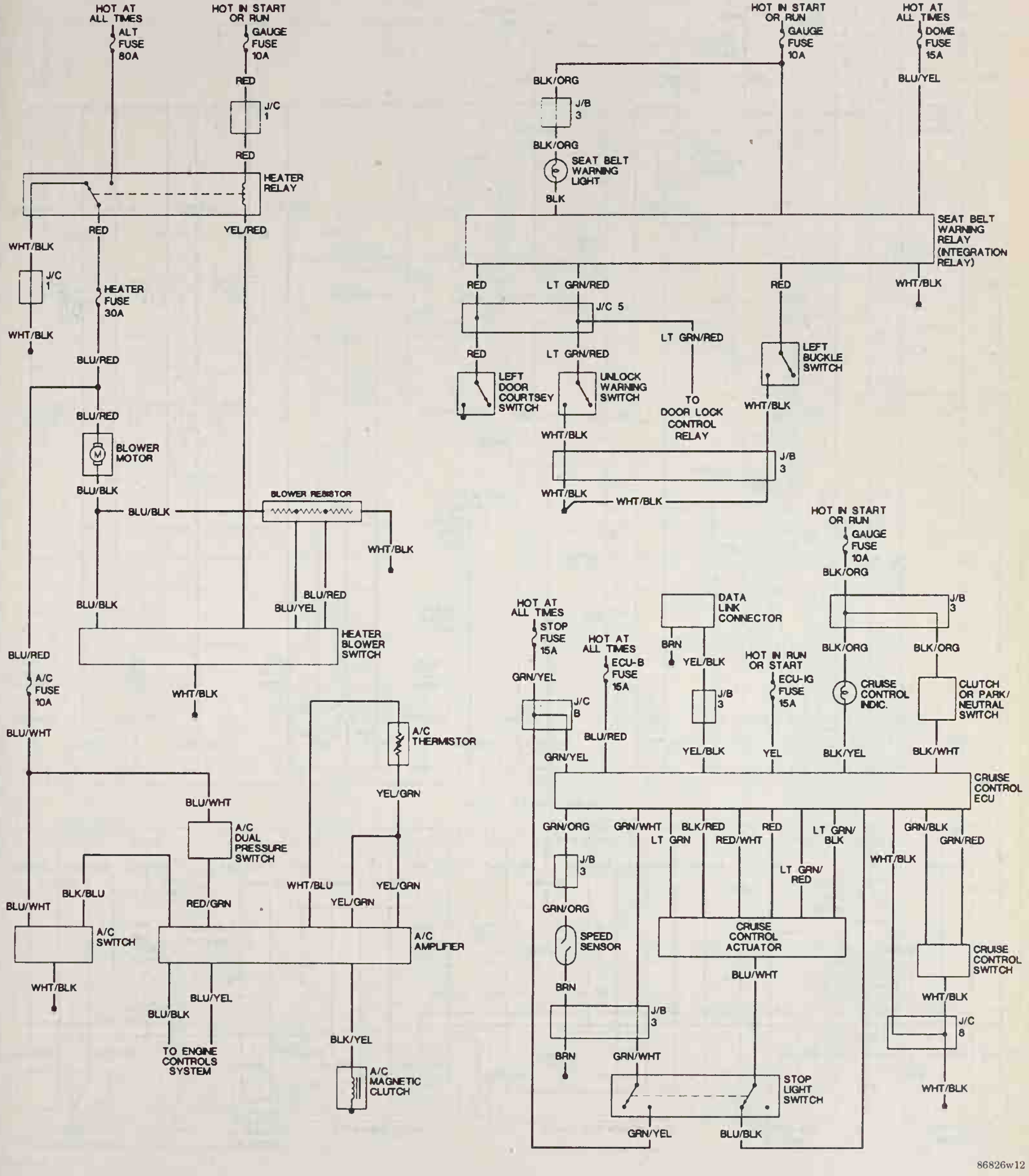

IGNITION SWITCH
WHT
BLK/RED
BLK
BLK/YEL
AM1 FUSE 40A
BLK/WHT
IGN FUSE 7.5A
GAUGE FUSE 10A
CHARGE INDIC.
RED
WHT
BLK/ORG
J/C 1
STARTER RELAY
J/B 3
ALT-S FUSE 7.5A
BLK/ORG
RED
WHT
WHT
YEL
CLUTCH START CANCEL SWITCH
BLK/RED
A/T
M/T
ALT FL 80A
ALTERNATOR
BLK/RED
BLK/RED
BLK/RED
J/B 3
BLK/RED
WHT
PARK/ NEUTRAL POSITION SWITCH
BLK/RED
BLK/WHT
BLK
CLUTCH START SWITCH
STARTER
BATTERY
WHT/BLK
WHT/BLK
WHT/BLK
J/B 3
WHT/BLK
WHT/BLK
TO INTEGRATION RELAY
HOT IN START OR RUN
WIPER FUSE 20A
BLU/WHT
BLU
BLU
WASHER MOTOR
WIPER MOTOR
BLU/ORG
BLU/WHT
BLU/BLK
YEL/BLU
WHT/BLK
WIPER/ WASHER SWITCH
WHT/BLK
HOT AT ALL TIMES
POWER FUSE 30A
BLK/ORG
BLU
DOOR LOCK CONTROL RELAY
LT GRN/RED
RED
RED/WHT
RED/WHT
RED/YEL
BLU
WHT/BLK
BLU/WHT
BLU/RED
J/C 2
J/C 5
J/C 2
J/C 2
RED/WHT
WHT/BLK
RED
BLU/BLK
WHT/BLK
BLU/RED
BLU/RED
BLU
LEFT DOOR COURTESY SWITCH
RIGHT DOOR COURTESY SWITCH
RIGHT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
POWER WINDOW MASTER SWITCH
J/C 2
WHT/ BLK
BLU/BLK
RED/BLU
LT GRN/RED
RED/YEL
RED/WHT
RED/WHT
BLU
BLU/GRN
BLU/YEL
RED/BLK
RED/GRN
UNLOCK WARNING SWITCH
LEFT DOOR LOCK CONTROL SWITCH
LEFT DOOR KEY LOCK AND UNLOCK SWITCH
LEFT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
RIGHT FRONT WINDOW SWITCH
WHT/BLK
WHT/BLK
WHT/BLK
RED/YEL
WHT/ BLK
RED/WHT
BLU/WHT
BLU/WHT
J/C 5
RED/YEL
RED/WHT
RED/YEL
RED/WHT
BLU/ORG
GRN/ORG
RIGHT DOOR LOCK CONTROL SWITCH
RIGHT DOOR KEY LOCK AND UNLOCK SWITCH
WHT/BLK
WHT/BLK
LEFT WINDOW MOTOR
RIGHT WINDOW MOTOR
86826w11

Fig. 124 Chassis wiring — Tacoma 1995-96


HOT AT ALL TIMES
ALT FUSE 80A
HOT IN START OR RUN
GAUGE FUSE 10A
RED
J/C 1
RED
HEATER RELAY
RED
YEL/RED
WHT/BLK
J/C 1
WHT/BLK
HEATER FUSE 30A
BLU/RED
BLU/RED
BLOWER MOTOR
BLU/BLK
BLU/BLK
BLOWER RESISTOR
WHT/BLK
BLU/RED
BLU/YEL
BLU/BLK
HEATER BLOWER SWITCH
BLU/RED
A/C FUSE 10A
BLU/WHT
WHT/BLK
A/C THERMISTOR
YEL/GRN
BLU/WHT
A/C DUAL PRESSURE SWITCH
BLK/BLU
BLU/WHT
RED/GRN
WHT/BLU
YEL/GRN
YEL/GRN
A/C SWITCH
A/C AMPLIFIER
WHT/BLK
BLU/YEL
BLU/BLK
TO ENGINE CONTROLS SYSTEM
BLK/YEL
A/C MAGNETIC CLUTCH
HOT IN START OR RUN
GAUGE FUSE 10A
HOT AT ALL TIMES
DOME FUSE 15A
BLK/ORG
J/B 3
BLK/ORG
SEAT BELT WARNING LIGHT
BLK
BLU/YEL
SEAT BELT WARNING RELAY (INTEGRATION RELAY)
RED
LT GRN/RED
J/C 5
RED
WHT/BLK
LT GRN/RED
RED
LT GRN/RED
LEFT DOOR COURTSEY SWITCH
UNLOCK WARNING SWITCH
TO DOOR LOCK CONTROL RELAY
LEFT BUCKLE SWITCH
WHT/BLK
WHT/BLK
J/B 3
WHT/BLK
WHT/BLK
HOT IN START OR RUN
GAUGE FUSE 10A
BLK/ORG
J/B 3
HOT AT ALL TIMES
STOP FUSE 15A
DATA LINK CONNECTOR
HOT AT ALL TIMES
ECU-B FUSE 15A
BRN
YEL/BLK
HOT IN RUN OR START
ECU-IG FUSE 15A
BLK/ORG
BLK/ORG
GRN/YEL
J/C 8
J/B 3
CRUISE CONTROL INDIC.
CLUTCH OR PARK/ NEUTRAL SWITCH
BLU/RED
GRN/YEL
YEL/BLK
YEL
BLK/YEL
BLK/WHT
CRUISE CONTROL ECU
GRN/ORG
GRN/WHT
LT GRN
BLK/RED
RED/WHT
RED
LT GRN/ BLK
GRN/BLK
GRN/RED
WHT/BLK
LT GRN/ RED
J/B 3
GRN/ORG
CRUISE CONTROL ACTUATOR
SPEED SENSOR
BLU/WHT
CRUISE CONTROL SWITCH
BRN
WHT/BLK
J/B 3
J/C 8
BRN
GRN/WHT
STOP LIGHT SWITCH
WHT/BLK
GRN/YEL
BLU/BLK

86826w12

Fig. 125 Chassis wiring — Tacoma 1995-96 continued

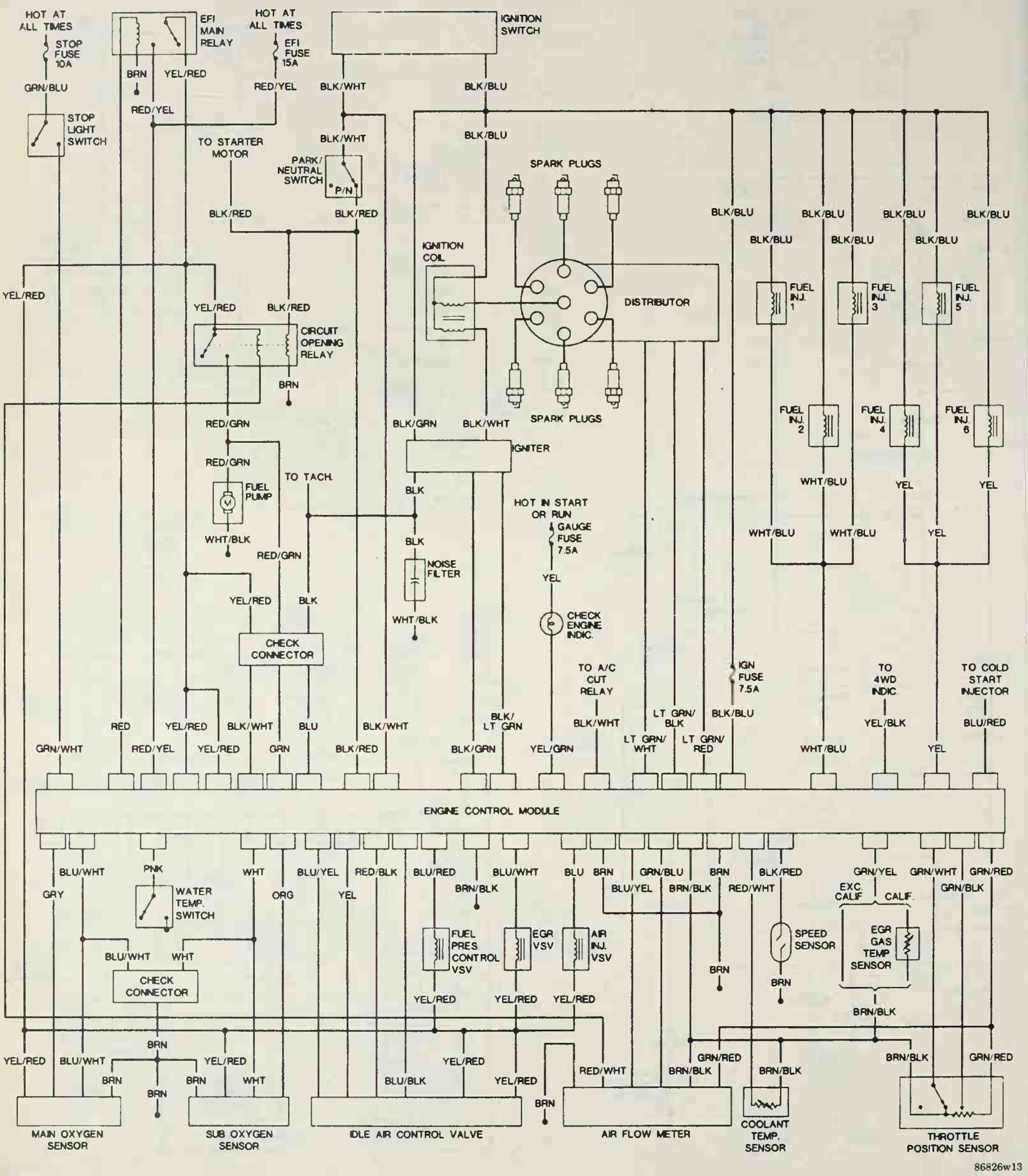

HOT AT ALL TIMES
STOP FUSE 10A
GRN/BLU
STOP LIGHT SWITCH
EFI MAIN RELAY
BRN
YEL/RED
RED/YEL
HOT AT ALL TIMES
EFI FUSE 15A
RED/YEL
IGNITION SWITCH
BLK/WHT
BLK/BLU
TO STARTER MOTOR
BLK/WHT
PARK/ NEUTRAL SWITCH
P/N
BLK/RED
BLK/RED
BLK/BLU
SPARK PLUGS
IGNITION COIL
DISTRIBUTOR
SPARK PLUGS
YEL/RED
YEL/RED
BLK/RED
CIRCUIT OPENING RELAY
BRN
RED/GRN
RED/GRN
FUEL PUMP
WHT/BLK
TO TACH.
RED/GRN
YEL/RED
BLK
CHECK CONNECTOR
BLK/GRN
BLK/WHT
IGNITER
BLK
BLK
NOISE FILTER
WHT/BLK
HOT IN START OR RUN
GAUGE FUSE 7.5A
YEL
CHECK ENGINE INDIC.
BLK/BLU
BLK/BLU
BLK/BLU
BLK/BLU
BLK/BLU
BLK/BLU
BLK/BLU
FUEL INJ. 1
FUEL INJ. 3
FUEL INJ. 5
FUEL INJ. 2
FUEL INJ. 4
FUEL INJ. 6
WHT/BLU
YEL
YEL
WHT/BLU
WHT/BLU
YEL
IGN FUSE 7.5A
TO A/C CUT RELAY
TO 4WD INDIC.
TO COLD START INJECTOR
BLK/WHT
LT GRN/ BLK
BLK/BLU
YEL/BLK
BLU/RED
RED
YEL/RED
BLK/WHT
BLU
BLK/WHT
BLK/ LT GRN
GRN/WHT
RED/YEL
YEL/RED
GRN
BLK/RED
BLK/GRN
YEL/GRN
LT GRN/ WHT
LT GRN/ RED
WHT/BLU
YEL
ENGINE CONTROL MODULE
BLU/WHT
GRY
PNK
WATER TEMP. SWITCH
WHT
ORG
BLU/YEL
YEL
RED/BLK
BLU/RED
BRN/BLK
BLU/WHT
BLU
BRN
GRN/BLU
BLU/YEL
BRN/BLK
BRN
RED/WHT
BLK/RED
GRN/YEL
GRN/WHT
GRN/RED
GRN/BLK
EXC. CALIF
CALIF.
FUEL PRES CONTROL VSV
EGR VSV
AIR INJ. VSV
SPEED SENSOR
EGR GAS TEMP SENSOR
BLU/WHT
WHT
CHECK CONNECTOR
BRN
BRN
YEL/RED
YEL/RED
YEL/RED
BRN/BLK
BRN
YEL/RED
BLU/WHT
YEL/RED
BRN
BRN
WHT
BRN
YEL/RED
BLU/BLK
YEL/RED
BRN
RED/WHT
GRN/RED
BRN/BLK
BRN/BLK
BRN/BLK
GRN/RED
MAIN OXYGEN SENSOR
SUB OXYGEN SENSOR
IDLE AIR CONTROL VALVE
AIR FLOW METER
COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w13

Fig. 126 Engine wiring — Land Cruiser 1989-90

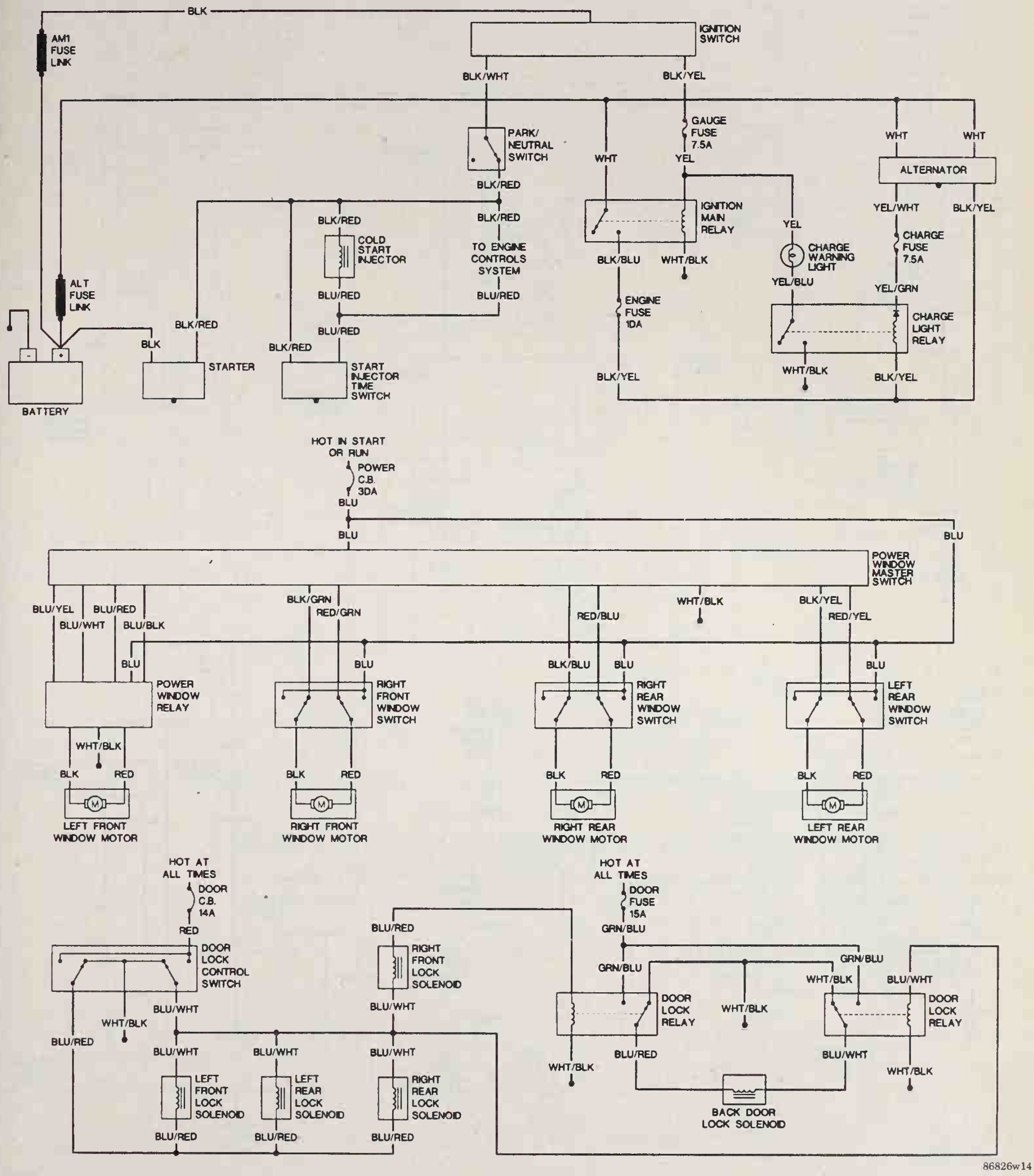
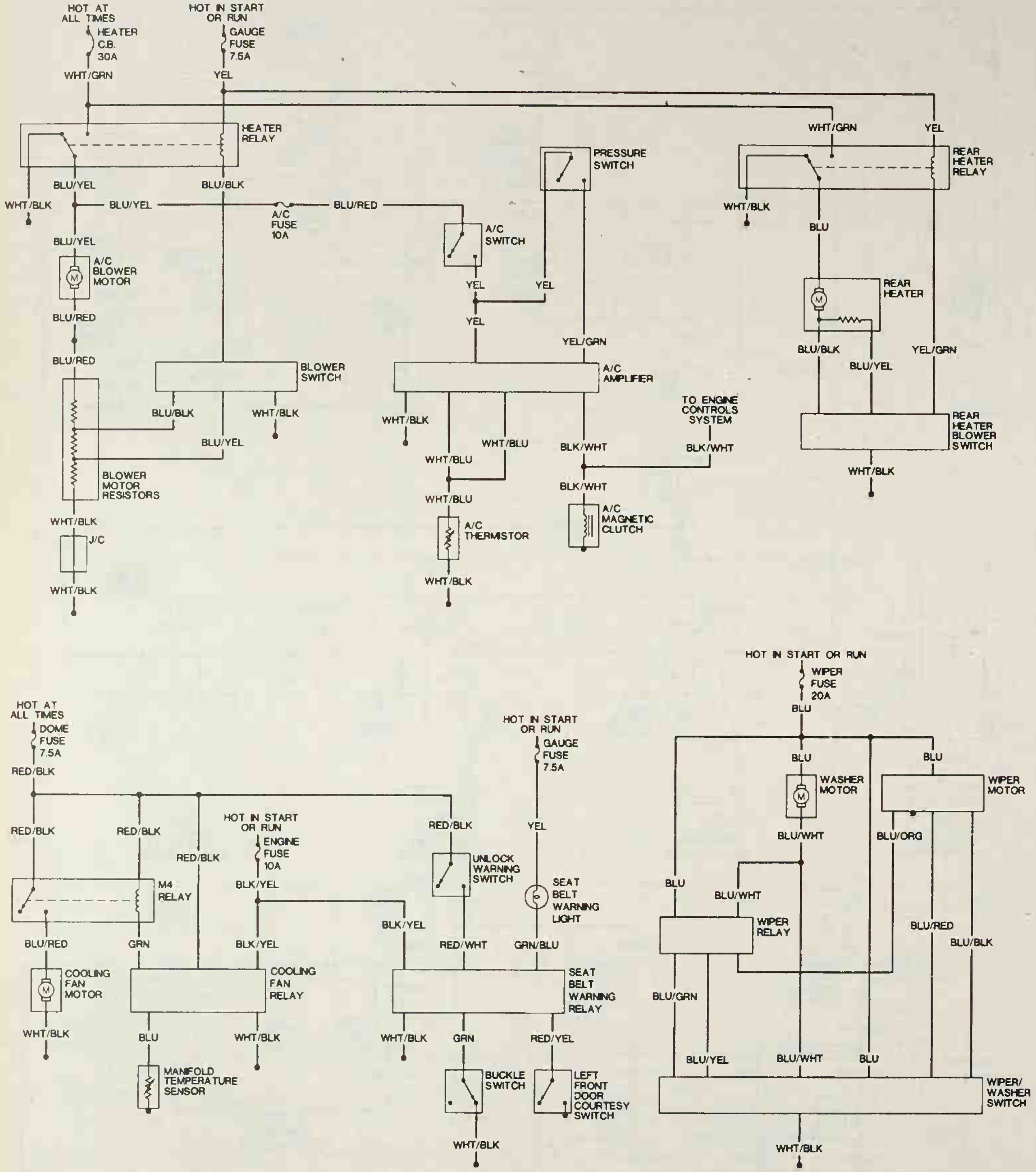

BLK
AM1 FUSE LINK
IGNITION SWITCH
BLK/WHT
BLK/YEL
PARK/ NEUTRAL SWITCH
GAUGE FUSE 7.5A
WHT
YEL
WHT
WHT
ALTERNATOR
BLK/RED
BLK/RED
BLK/RED
COLD START INJECTOR
TO ENGINE CONTROLS SYSTEM
IGNITION MAIN RELAY
YEL
YEL/WHT
BLK/YEL
CHARGE FUSE 7.5A
BLK/BLU
WHT/BLK
CHARGE WARNING LIGHT
YEL/BLU
YEL/GRN
BLU/RED
BLU/RED
ENGINE FUSE 10A
CHARGE LIGHT RELAY
ALT FUSE LINK
BLK/RED
BLU/RED
BLK
BLK/RED
STARTER
START INJECTOR TIME SWITCH
WHT/BLK
BLK/YEL
BLK/YEL
BATTERY
HOT IN START OR RUN
POWER C.B. 30A
BLU
BLU
BLU
POWER WINDOW MASTER SWITCH
BLU/YEL
BLU/RED
BLU/WHT
BLU/BLK
BLK/GRN
RED/GRN
RED/BLU
WHT/BLK
BLK/YEL
RED/YEL
BLU
BLU
BLK/BLU
BLU
BLU
POWER WINDOW RELAY
RIGHT FRONT WINDOW SWITCH
RIGHT REAR WINDOW SWITCH
LEFT REAR WINDOW SWITCH
WHT/BLK
BLK
RED
BLK
RED
BLK
RED
BLK
RED
M
M
M
M
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
RIGHT REAR WINDOW MOTOR
LEFT REAR WINDOW MOTOR
HOT AT ALL TIMES
DOOR C.B. 14A
RED
HOT AT ALL TIMES
DOOR FUSE 15A
GRN/BLU
BLU/RED
RIGHT FRONT LOCK SOLENOID
DOOR LOCK CONTROL SWITCH
GRN/BLU
GRN/BLU
WHT/BLK
BLU/WHT
DOOR LOCK RELAY
WHT/BLK
DOOR LOCK RELAY
BLU/WHT
BLU/WHT
WHT/BLK
BLU/RED
BLU/WHT
BLU/WHT
BLU/WHT
BLU/RED
BLU/WHT
WHT/BLK
WHT/BLK
LEFT FRONT LOCK SOLENOID
LEFT REAR LOCK SOLENOID
RIGHT REAR LOCK SOLENOID
BACK DOOR LOCK SOLENOID
BLU/RED
BLU/RED
BLU/RED
86826w14

Fig. 127 Chassis wiring — Land Cruiser 1989-90


HOT AT ALL TIMES
HEATER C.B. 30A
WHT/GRN
HOT IN START OR RUN
GAUGE FUSE 7.5A
YEL
HEATER RELAY
WHT/GRN
YEL
REAR HEATER RELAY
PRESSURE SWITCH
BLU/YEL
BLU/BLK
WHT/BLK
BLU/YEL
A/C FUSE 10A
BLU/RED
WHT/BLK
BLU
A/C SWITCH
BLU/YEL
A/C BLOWER MOTOR
YEL
YEL
YEL
REAR HEATER
BLU/RED
YEL/GRN
BLU/BLK
YEL/GRN
BLU/RED
BLOWER SWITCH
A/C AMPLIFIER
BLU/YEL
BLU/BLK
WHT/BLK
WHT/BLK
TO ENGINE CONTROLS SYSTEM
REAR HEATER BLOWER SWITCH
BLU/YEL
WHT/BLU
BLK/WHT
BLK/WHT
WHT/BLU
WHT/BLK
BLOWER MOTOR RESISTORS
BLK/WHT
WHT/BLU
WHT/BLK
J/C
A/C THERMISTOR
A/C MAGNETIC CLUTCH
WHT/BLK
WHT/BLK
HOT IN START OR RUN
WIPER FUSE 20A
BLU
HOT AT ALL TIMES
DOME FUSE 7.5A
RED/BLK
HOT IN START OR RUN
GAUGE FUSE 7.5A
BLU
BLU
WASHER MOTOR
WIPER MOTOR
RED/BLK
RED/BLK
HOT IN START OR RUN
ENGINE FUSE 10A
RED/BLK
YEL
BLU/WHT
BLU/ORG
RED/BLK
BLK/YEL
UNLOCK WARNING SWITCH
M4 RELAY
SEAT BELT WARNING LIGHT
BLU
BLU/WHT
WIPER RELAY
BLK/YEL
BLU/RED
BLU/RED
GRN
BLK/YEL
RED/WHT
GRN/BLU
BLU/BLK
COOLING FAN MOTOR
COOLING FAN RELAY
SEAT BELT WARNING RELAY
BLU/GRN
WHT/BLK
BLU
WHT/BLK
WHT/BLK
GRN
RED/YEL
BLU/YEL
BLU/WHT
BLU
MANIFOLD TEMPERATURE SENSOR
BUCKLE SWITCH
LEFT FRONT DOOR COURTESY SWITCH
WIPER/WASHER SWITCH
WHT/BLK
WHT/BLK

86826w15

Fig. 128 Chassis wiring — Land Cruiser 1989-90 continued

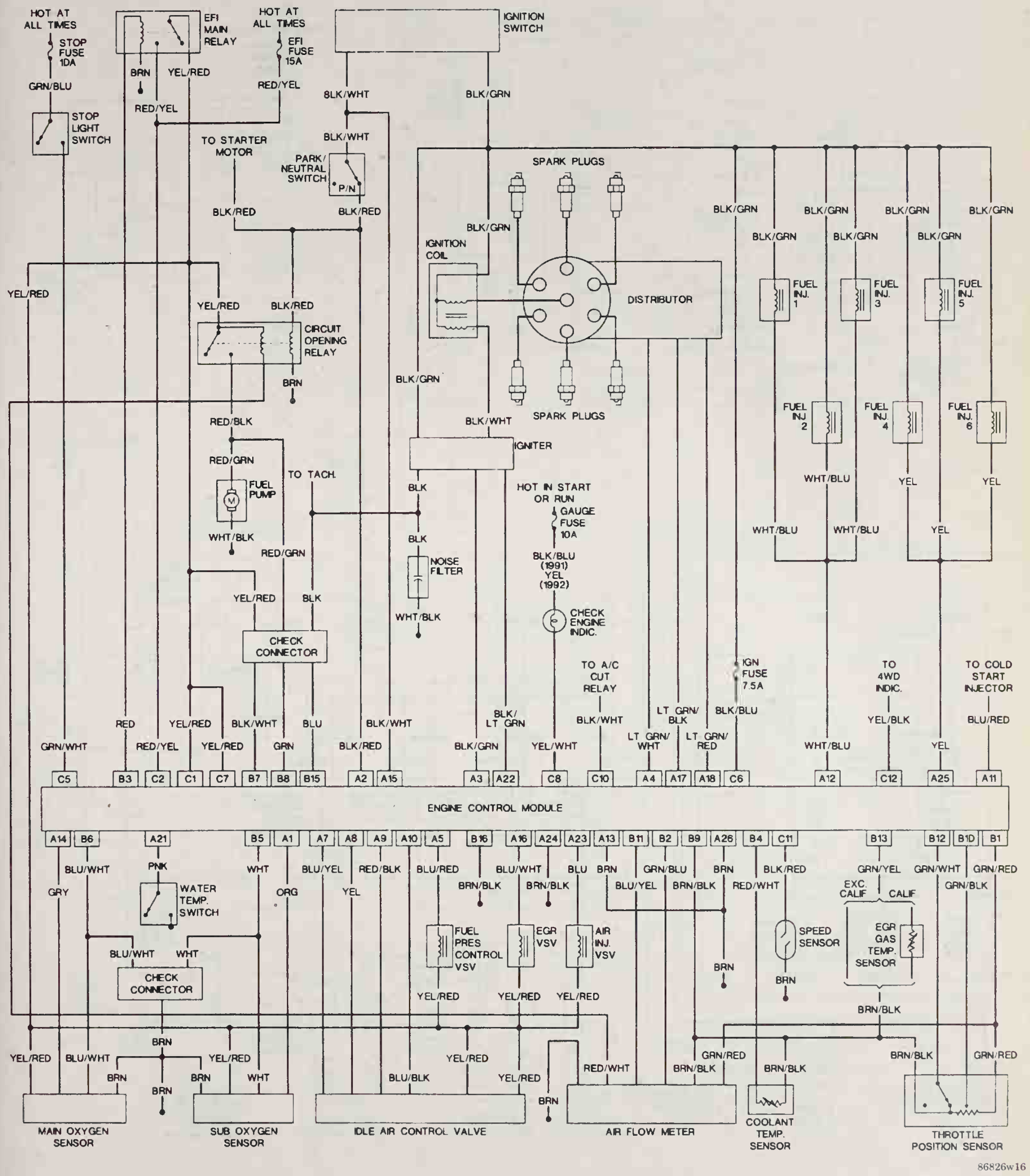

HOT AT ALL TIMES
STOP FUSE 1DA
GRN/BLU
STOP LIGHT SWITCH
EFI MAIN RELAY
BRN
YEL/RED
RED/YEL
HOT AT ALL TIMES
EFI FUSE 15A
RED/YEL
IGNITION SWITCH
BLK/WHT
BLK/GRN
TO STARTER MOTOR
PARK/NEUTRAL SWITCH
P/N
BLK/RED
BLK/RED
SPARK PLUGS
IGNITION COIL
DISTRIBUTOR
SPARK PLUGS
FUEL INJ. 1
FUEL INJ. 3
FUEL INJ. 5
FUEL INJ. 2
FUEL INJ. 4
FUEL INJ. 6
BLK/GRN
YEL/RED
YEL/RED
BLK/RED
CIRCUIT OPENING RELAY
BRN
RED/BLK
RED/GRN
FUEL PUMP
WHT/BLK
RED/GRN
TO TACH.
BLK/GRN
BLK/WHT
IGNITER
BLK
BLK
NOISE FILTER
WHT/BLK
HOT IN START OR RUN
GAUGE FUSE 10A
BLK/BLU (1991) YEL (1992)
CHECK ENGINE INDIC.
WHT/BLU
YEL
YEL/RED
BLK
CHECK CONNECTOR
TO A/C CUT RELAY
IGN FUSE 7.5A
TO 4WD INDIC.
TO COLD START INJECTOR
GRN/WHT
RED
RED/YEL
YEL/RED
YEL/RED
BLK/WHT
GRN
BLU
BLK/RED
BLK/WHT
BLK/GRN
BLK/ LT GRN
YEL/WHT
BLK/WHT
LT GRN/ WHT
LT GRN/ BLK
LT GRN/ RED
BLK/BLU
WHT/BLU
YEL/BLK
YEL
BLU/RED
C5
B3
C2
C1
C7
B7
B8
B15
A2
A15
A3
A22
C8
C10
A4
A17
A18
C6
A12
C12
A25
A11
ENGINE CONTROL MODULE
A14
B6
A21
B5
A1
A7
A8
A9
A10
A5
B16
A16
A24
A23
A13
B11
B2
B9
A26
B4
C11
B13
B12
B10
B1
GRY
BLU/WHT
PNK
WATER TEMP. SWITCH
WHT
ORG
BLU/YEL
YEL
RED/BLK
BLU/RED
BRN/BLK
BLU/WHT
BRN/BLK
BLU
BRN
BLU/YEL
GRN/BLU
BRN/BLK
BRN
RED/WHT
BLK/RED
GRN/YEL
GRN/WHT
GRN/RED
GRN/BLK
EXC. CALIF
CALIF
FUEL PRES CONTROL VSV
EGR VSV
AIR INJ. VSV
SPEED SENSOR
EGR GAS TEMP. SENSOR
BLU/WHT
WHT
CHECK CONNECTOR
YEL/RED
YEL/RED
YEL/RED
BRN
BRN
BRN/BLK
YEL/RED
BLU/WHT
BRN
BRN
YEL/RED
WHT
BRN
BLU/BLK
YEL/RED
YEL/RED
BRN
RED/WHT
GRN/RED
BRN/BLK
BRN/BLK
BRN/BLK
GRN/RED
MAIN OXYGEN SENSOR
SUB OXYGEN SENSOR
IDLE AIR CONTROL VALVE
AIR FLOW METER
COOLANT TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w16

Fig. 129 Engine wiring — Land Cruiser 1991-92

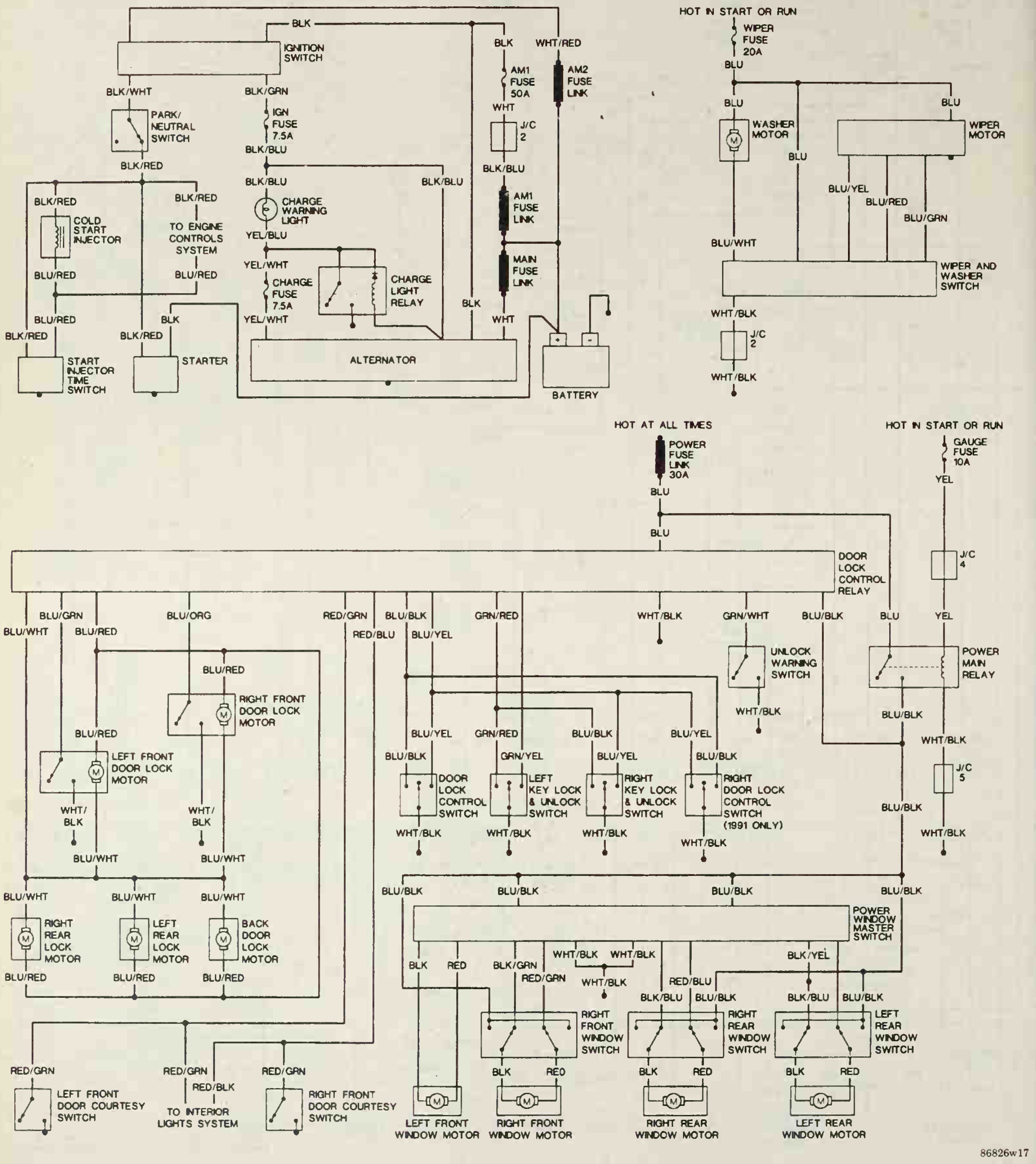

BLK
IGNITION SWITCH
BLK
WHT/RED
AM1 FUSE 50A
AM2 FUSE LINK
WHT
J/C 2
BLK/BLU
AM1 FUSE LINK
MAIN FUSE LINK
BLK/WHT
PARK/ NEUTRAL SWITCH
BLK/RED
BLK/GRN
IGN FUSE 7.5A
BLK/BLU
BLK/BLU
CHARGE WARNING LIGHT
YEL/BLU
YEL/WHT
CHARGE FUSE 7.5A
YEL/WHT
CHARGE LIGHT RELAY
BLK
WHT
BLK/RED
COLD START INJECTOR
BLU/RED
BLU/RED
BLK/RED
BLK/RED
TO ENGINE CONTROLS SYSTEM
BLU/RED
BLK
BLK/RED
START INJECTOR TIME SWITCH
STARTER
ALTERNATOR
BATTERY
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
WASHER MOTOR
BLU
BLU
WIPER MOTOR
BLU/YEL
BLU/RED
BLU/GRN
BLU/WHT
WIPER AND WASHER SWITCH
WHT/BLK
J/C 2
WHT/BLK
HOT AT ALL TIMES
POWER FUSE LINK 30A
BLU
BLU
HOT IN START OR RUN
GAUGE FUSE 10A
YEL
DOOR LOCK CONTROL RELAY
J/C 4
BLU/GRN
BLU/WHT
BLU/RED
BLU/ORG
RED/GRN
RED/BLU
BLU/BLK
BLU/YEL
GRN/RED
WHT/BLK
GRN/WHT
BLU/BLK
BLU
YEL
BLU/RED
RIGHT FRONT DOOR LOCK MOTOR
BLU/RED
LEFT FRONT DOOR LOCK MOTOR
WHT/ BLK
WHT/ BLK
BLU/WHT
BLU/WHT
UNLOCK WARNING SWITCH
WHT/BLK
POWER MAIN RELAY
BLU/BLK
WHT/BLK
J/C 5
BLU/BLK
WHT/BLK
BLU/YEL
GRN/RED
BLU/BLK
BLU/YEL
BLU/BLK
GRN/YEL
BLU/YEL
BLU/BLK
DOOR LOCK CONTROL SWITCH
LEFT KEY LOCK & UNLOCK SWITCH
RIGHT KEY LOCK & UNLOCK SWITCH
RIGHT DOOR LOCK CONTROL SWITCH (1991 ONLY)
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
BLU/WHT
BLU/WHT
BLU/WHT
RIGHT REAR LOCK MOTOR
LEFT REAR LOCK MOTOR
BACK DOOR LOCK MOTOR
BLU/RED
BLU/RED
BLU/RED
BLU/BLK
BLU/BLK
BLU/BLK
BLU/BLK
POWER WINDOW MASTER SWITCH
BLK
RED
BLK/GRN
RED/GRN
WHT/BLK
WHT/BLK
WHT/BLK
RED/BLU
BLK/YEL
BLK/BLU
BLU/BLK
BLK/BLU
BLU/BLK
RIGHT FRONT WINDOW SWITCH
RIGHT REAR WINDOW SWITCH
LEFT REAR WINDOW SWITCH
BLK
RED
BLK
RED
BLK
RED
RED/GRN
LEFT FRONT DOOR COURTESY SWITCH
RED/GRN
RED/BLK
TO INTERIOR LIGHTS SYSTEM
RED/GRN
RIGHT FRONT DOOR COURTESY SWITCH
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
RIGHT REAR WINDOW MOTOR
LEFT REAR WINDOW MOTOR
86826w17

Fig. 130 Chassis wiring — Land Cruiser 1991-92

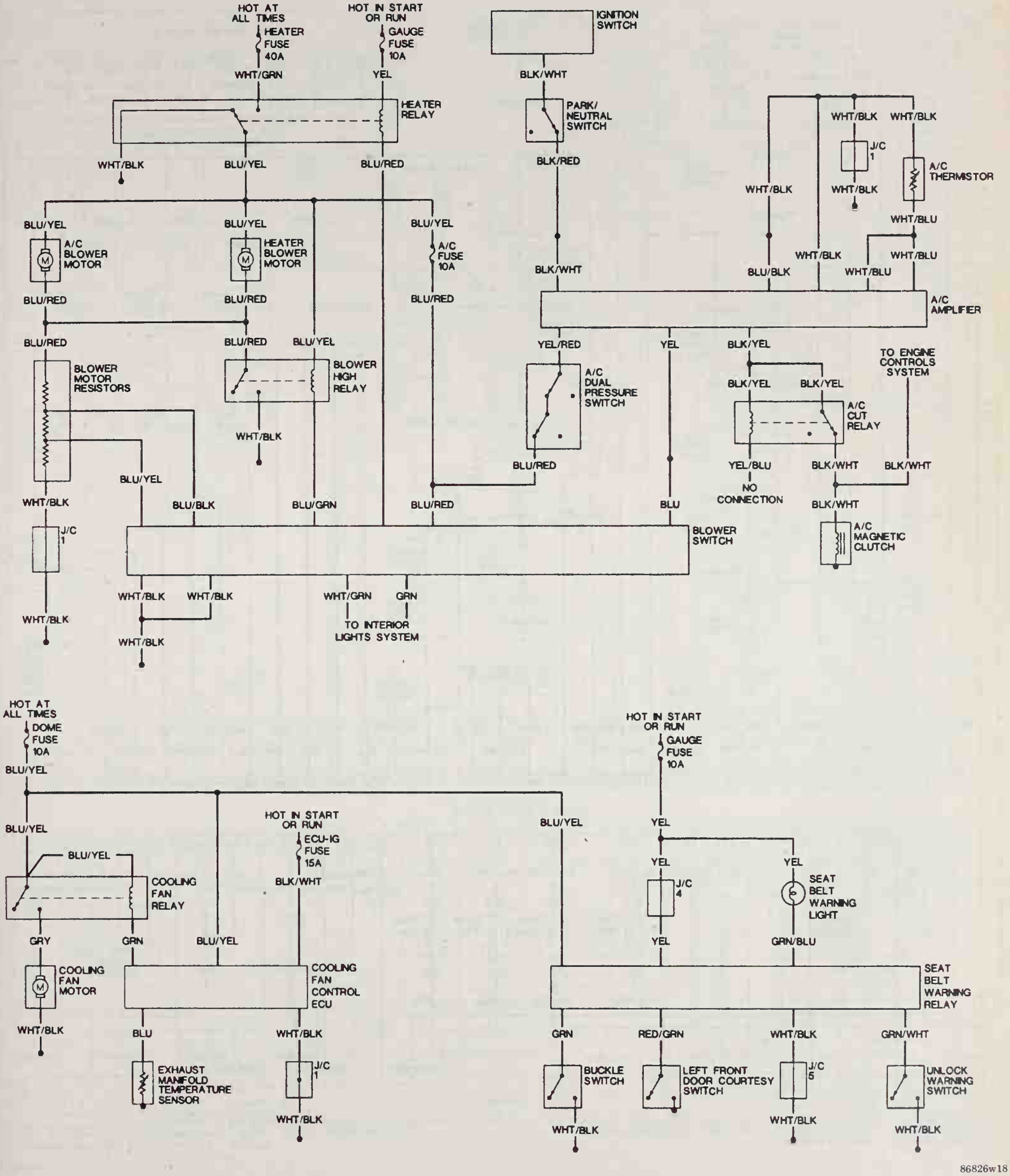
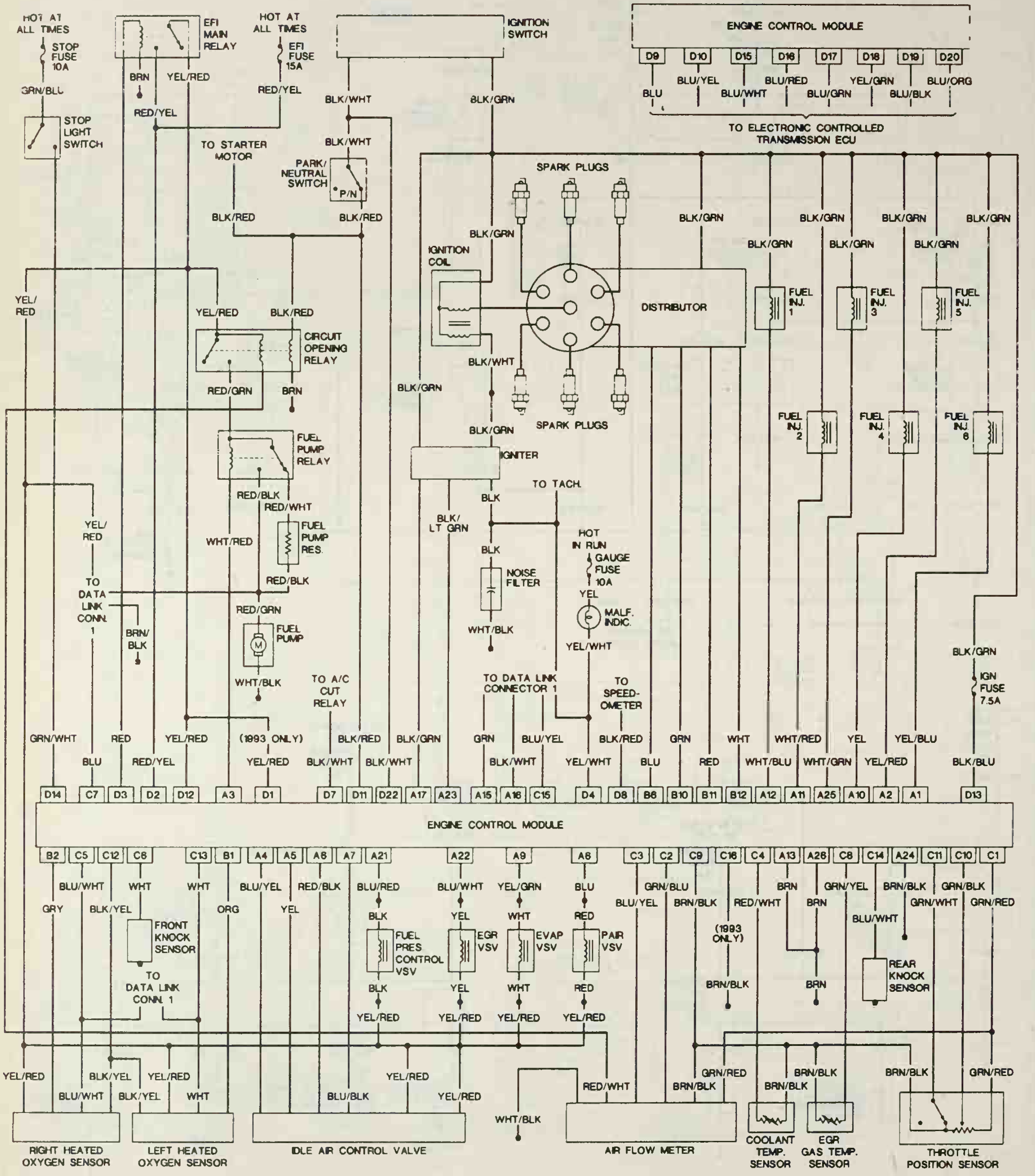

HOT AT ALL TIMES
HEATER FUSE 40A
WHT/GRN
HOT IN START OR RUN
GAUGE FUSE 10A
YEL
IGNITION SWITCH
BLK/WHT
HEATER RELAY
PARK/ NEUTRAL SWITCH
WHT/BLK
BLU/YEL
BLU/RED
BLK/RED
WHT/BLK
WHT/BLK
J/C 1
A/C THERMISTOR
WHT/BLK
WHT/BLK
WHT/BLU
BLU/YEL
A/C BLOWER MOTOR
BLU/YEL
HEATER BLOWER MOTOR
BLU/YEL
A/C FUSE 10A
WHT/BLK
WHT/BLU
BLK/WHT
BLU/BLK
WHT/BLU
BLU/RED
BLU/RED
BLU/RED
A/C AMPLIFIER
BLU/RED
BLU/RED
BLU/YEL
BLOWER HIGH RELAY
YEL/RED
YEL
BLK/YEL
TO ENGINE CONTROLS SYSTEM
BLOWER MOTOR RESISTORS
A/C DUAL PRESSURE SWITCH
BLK/YEL
BLK/YEL
A/C CUT RELAY
WHT/BLK
BLU/YEL
BLU/RED
YEL/BLU
BLK/WHT
BLK/WHT
NO CONNECTION
WHT/BLK
BLU/BLK
BLU/GRN
BLU/RED
BLU
BLK/WHT
J/C 1
BLOWER SWITCH
A/C MAGNETIC CLUTCH
WHT/BLK
WHT/BLK
WHT/GRN
GRN
WHT/BLK
TO INTERIOR LIGHTS SYSTEM
WHT/BLK
HOT AT ALL TIMES
DOME FUSE 10A
BLU/YEL
HOT IN START OR RUN
GAUGE FUSE 10A
BLU/YEL
HOT IN START OR RUN
ECU-IG FUSE 15A
BLU/YEL
YEL
BLU/YEL
BLK/WHT
YEL
YEL
COOLING FAN RELAY
J/C 4
SEAT BELT WARNING LIGHT
GRY
GRN
BLU/YEL
YEL
GRN/BLU
COOLING FAN MOTOR
COOLING FAN CONTROL ECU
SEAT BELT WARNING RELAY
WHT/BLK
BLU
WHT/BLK
GRN
RED/GRN
WHT/BLK
GRN/WHT
EXHAUST MANIFOLD TEMPERATURE SENSOR
J/C 1
BUCKLE SWITCH
LEFT FRONT DOOR COURTESY SWITCH
J/C 5
UNLOCK WARNING SWITCH
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
86826w18

Fig. 131 Chassis wiring — Land Cruiser 1991-92 continued


HOT AT ALL TIMES
STOP FUSE 10A
GRN/BLU
STOP LIGHT SWITCH
EFI MAIN RELAY
BRN
YEL/RED
RED/YEL
HOT AT ALL TIMES
EFI FUSE 15A
RED/YEL
IGNITION SWITCH
BLK/WHT
BLK/GRN
ENGINE CONTROL MODULE
D9
D10
D15
D16
D17
D18
D19
D20
BLU
BLU/YEL
BLU/WHT
BLU/RED
BLU/GRN
YEL/GRN
BLU/BLK
BLU/ORG
TO ELECTRONIC CONTROLLED TRANSMISSION ECU
TO STARTER MOTOR
PARK/ NEUTRAL SWITCH
P/N
BLK/WHT
BLK/RED
BLK/RED
SPARK PLUGS
BLK/GRN
IGNITION COIL
DISTRIBUTOR
BLK/GRN
BLK/GRN
BLK/GRN
BLK/GRN
BLK/GRN
BLK/GRN
BLK/GRN
FUEL INJ. 1
FUEL INJ. 3
FUEL INJ. 5
FUEL INJ. 2
FUEL INJ. 4
FUEL INJ. 6
YEL/ RED
YEL/RED
BLK/RED
CIRCUIT OPENING RELAY
RED/GRN
BRN
BLK/WHT
BLK/GRN
SPARK PLUGS
BLK/GRN
FUEL PUMP RELAY
IGNITER
RED/BLK
RED/WHT
FUEL PUMP RES.
YEL/ RED
WHT/RED
RED/BLK
TO DATA LINK CONN. 1
BRN/ BLK
RED/GRN
FUEL PUMP
WHT/BLK
TO A/C CUT RELAY
BLK/ LT GRN
BLK
TO TACH.
BLK
NOISE FILTER
WHT/BLK
HOT IN RUN
GAUGE FUSE 10A
YEL
MALF. INDIC.
YEL/WHT
TO DATA LINK CONNECTOR 1
TO SPEED- OMETER
BLK/GRN
IGN FUSE 7.5A
GRN/WHT
BLU
RED
RED/YEL
YEL/RED
(1993 ONLY)
YEL/RED
BLK/RED
BLK/WHT
BLK/GRN
BLK/WHT
GRN
BLK/WHT
BLU/YEL
YEL/WHT
BLK/RED
BLU
GRN
RED
WHT
WHT/BLU
WHT/RED
WHT/GRN
YEL
YEL/RED
YEL/BLU
BLK/BLU
D14
C7
D3
D2
D12
A3
D1
D7
D11
D22
A17
A23
A15
A16
C15
D4
D8
B6
B10
B11
B12
A12
A11
A25
A10
A2
A1
D13
ENGINE CONTROL MODULE
B2
C5
C12
C6
C13
B1
A4
A5
A6
A7
A21
A22
A9
A8
C3
C2
C9
C16
C4
A13
A26
C8
C14
A24
C11
C10
C1
GRY
BLU/WHT
BLK/YEL
WHT
WHT
ORG
BLU/YEL
YEL
RED/BLK
BLU/RED
BLU/WHT
YEL/GRN
BLU
BLU/YEL
GRN/BLU
BRN/BLK
RED/WHT
BRN
BRN
GRN/YEL
BRN/BLK
GRN/BLK
GRN/WHT
GRN/RED
BLU/WHT
FRONT KNOCK SENSOR
TO DATA LINK CONN. 1
BLK
FUEL PRES CONTROL VSV
BLK
YEL
EGR VSV
YEL
WHT
EVAP VSV
WHT
RED
PAIR VSV
RED
YEL/RED
YEL/RED
YEL/RED
YEL/RED
(1993 ONLY)
BRN/BLK
BRN
REAR KNOCK SENSOR
YEL/RED
BLU/WHT
BLK/YEL
BLK/YEL
YEL/RED
WHT
BLU/BLK
YEL/RED
YEL/RED
WHT/BLK
RED/WHT
GRN/RED
BRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
GRN/RED
RIGHT HEATED OXYGEN SENSOR
LEFT HEATED OXYGEN SENSOR
IDLE AIR CONTROL VALVE
AIR FLOW METER
COOLANT TEMP. SENSOR
EGR GAS TEMP. SENSOR
THROTTLE POSITION SENSOR

86826w19

Fig. 132 Engine wiring — Land Cruiser 1993-94

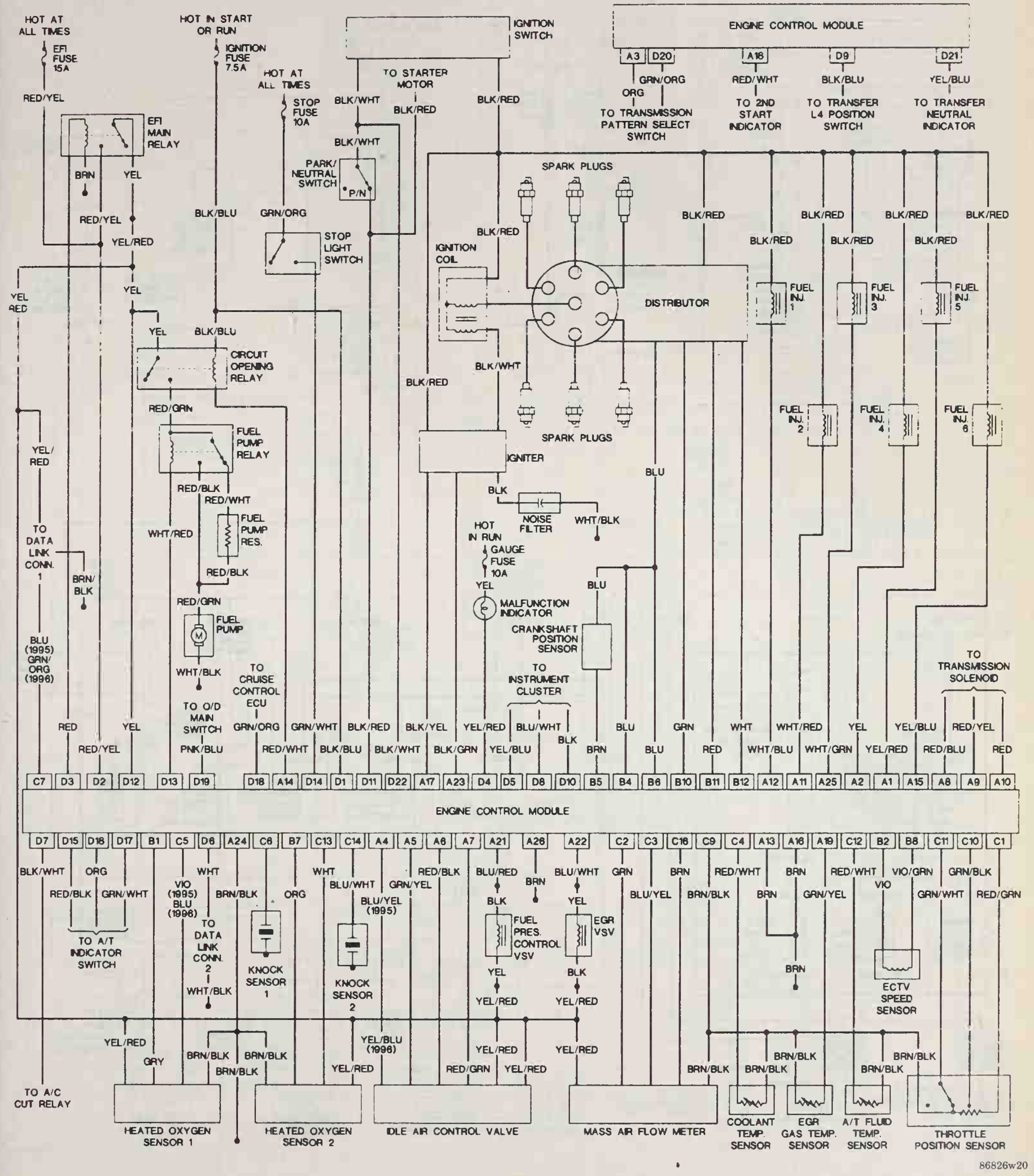
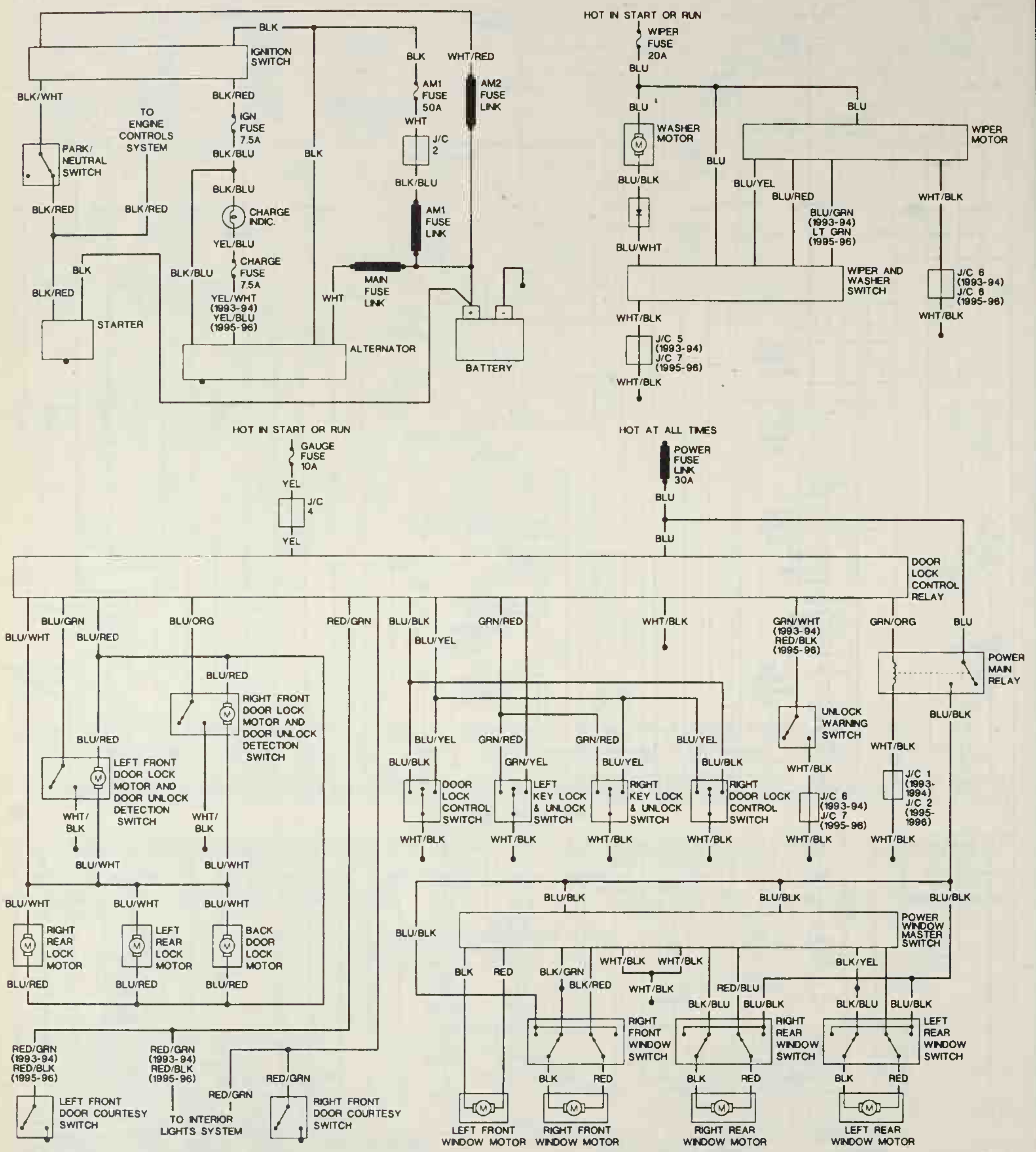

HOT AT ALL TIMES
EFI FUSE 15A
RED/YEL
EFI MAIN RELAY
BRN
YEL
RED/YEL
YEL/RED
YEL RED
HOT IN START OR RUN
IGNITION FUSE 7.5A
HOT AT ALL TIMES
STOP FUSE 10A
BLK/BLU
GRN/ORG
STOP LIGHT SWITCH
IGNITION SWITCH
TO STARTER MOTOR
BLK/WHT
BLK/RED
PARK/ NEUTRAL SWITCH
P/N
ENGINE CONTROL MODULE
A3
D20
A16
D9
D21
GRN/ORG
ORG
TO TRANSMISSION PATTERN SELECT SWITCH
RED/WHT
TO 2ND START INDICATOR
BLK/BLU
TO TRANSFER L4 POSITION SWITCH
YEL/BLU
TO TRANSFER NEUTRAL INDICATOR
SPARK PLUGS
IGNITION COIL
DISTRIBUTOR
FUEL INJ. 1
FUEL INJ. 3
FUEL INJ. 5
FUEL INJ. 2
FUEL INJ. 4
FUEL INJ. 6
YEL
BLK/BLU
CIRCUIT OPENING RELAY
RED/GRN
FUEL PUMP RELAY
RED/BLK
RED/WHT
FUEL PUMP RES.
WHT/RED
RED/BLK
RED/GRN
FUEL PUMP
WHT/BLK
YEL/ RED
TO DATA LINK CONN. 1
BRN/ BLK
BLU (1995) GRN/ ORG (1996)
TO O/D MAIN SWITCH
TO CRUISE CONTROL ECU
IGNITER
BLK
NOISE FILTER
WHT/BLK
HOT IN RUN
GAUGE FUSE 10A
YEL
MALFUNCTION INDICATOR
BLU
CRANKSHAFT POSITION SENSOR
TO INSTRUMENT CLUSTER
TO TRANSMISSION SOLENOID
RED
YEL
RED/YEL
PNK/BLU
GRN/ORG
RED/WHT
GRN/WHT
BLK/BLU
BLK/RED
BLK/WHT
BLK/YEL
BLK/GRN
YEL/RED
YEL/BLU
BLU/WHT
BLK
BRN
BLU
GRN
WHT
WHT/BLU
WHT/RED
WHT/GRN
YEL/BLU
YEL/RED
RED/BLU
RED/YEL
RED
C7
D3
D2
D12
D13
D19
D18
A14
D14
D1
D11
D22
A17
A23
D4
D5
D8
D10
B5
B4
B6
B10
B11
B12
A12
A11
A25
A2
A1
A15
A8
A9
A10
ENGINE CONTROL MODULE
D7
D15
D16
D17
B1
C5
D6
A24
C6
B7
C13
C14
A4
A5
A6
A7
A21
A26
A22
C2
C3
C16
C9
C4
A13
A16
A19
C12
B2
B8
C11
C10
C1
BLK/WHT
ORG
RED/BLK
GRN/WHT
TO A/T INDICATOR SWITCH
WHT
VIO (1995) BLU (1996)
BRN/BLK
TO DATA LINK CONN. 2
WHT/BLK
KNOCK SENSOR 1
ORG
WHT
BLU/WHT
GRN/YEL
BLU/YEL (1995)
KNOCK SENSOR 2
RED/BLK
BLU/RED
BRN
BLK
FUEL PRES. CONTROL VSV
YEL
YEL/RED
BLU/WHT
YEL
EGR VSV
BLK
YEL/RED
GRN
BLU/YEL
BRN
BRN/BLK
RED/WHT
BRN
BRN
GRN/YEL
RED/WHT
VIO/GRN
VIO
GRN/BLK
GRN/WHT
RED/GRN
ECTV SPEED SENSOR
YEL/RED
GRY
BRN/BLK
BRN/BLK
BRN/BLK
YEL/BLU (1996)
YEL/RED
YEL/RED
RED/GRN
YEL/RED
YEL/RED
BRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
TO A/C CUT RELAY
HEATED OXYGEN SENSOR 1
HEATED OXYGEN SENSOR 2
IDLE AIR CONTROL VALVE
MASS AIR FLOW METER
COOLANT TEMP. SENSOR
EGR GAS TEMP. SENSOR
A/T FLUID TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w20

Fig. 133 Engine wiring — Land Cruiser 1995-96


BLK
IGNITION SWITCH
BLK
WHT/RED
BLK/WHT
BLK/RED
IGN FUSE 7.5A
AM1 FUSE 50A
AM2 FUSE LINK
WHT
J/C 2
TO ENGINE CONTROLS SYSTEM
PARK/NEUTRAL SWITCH
BLK/BLU
BLK
BLK/BLU
BLK/BLU
CHARGE INDIC.
AM1 FUSE LINK
BLK/RED
BLK/RED
YEL/BLU
BLK
CHARGE FUSE 7.5A
BLK/BLU
MAIN FUSE LINK
BLK/RED
WHT
YEL/WHT (1993-94) YEL/BLU (1995-96)
STARTER
ALTERNATOR
BATTERY
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
BLU
WASHER MOTOR
WIPER MOTOR
BLU
BLU/BLK
BLU/YEL
BLU/RED
BLU/GRN (1993-94) LT GRN (1995-96)
WHT/BLK
BLU/WHT
WIPER AND WASHER SWITCH
J/C 6 (1993-94) J/C 8 (1995-96)
WHT/BLK
WHT/BLK
J/C 5 (1993-94) J/C 7 (1995-96)
WHT/BLK
HOT IN START OR RUN
GAUGE FUSE 10A
YEL
J/C 4
YEL
HOT AT ALL TIMES
POWER FUSE LINK 30A
BLU
BLU
DOOR LOCK CONTROL RELAY
BLU/GRN
BLU/WHT
BLU/RED
BLU/ORG
RED/GRN
BLU/BLK
BLU/YEL
GRN/RED
WHT/BLK
GRN/WHT (1993-94) RED/BLK (1995-96)
GRN/ORG
BLU
POWER MAIN RELAY
BLU/RED
RIGHT FRONT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
UNLOCK WARNING SWITCH
BLU/BLK
BLU/RED
LEFT FRONT DOOR LOCK MOTOR AND DOOR UNLOCK DETECTION SWITCH
WHT/BLK
WHT/BLK
WHT/BLK
BLU/YEL
GRN/RED
GRN/RED
BLU/YEL
BLU/BLK
GRN/YEL
BLU/YEL
BLU/BLK
DOOR LOCK CONTROL SWITCH
LEFT KEY LOCK & UNLOCK SWITCH
RIGHT KEY LOCK & UNLOCK SWITCH
RIGHT DOOR LOCK CONTROL SWITCH
J/C 6 (1993-94) J/C 7 (1995-96)
J/C 1 (1993-1994) J/C 2 (1995-1996)
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
WHT/BLK
BLU/WHT
BLU/WHT
BLU/WHT
BLU/WHT
BLU/WHT
BLU/BLK
BLU/BLK
BLU/BLK
RIGHT REAR LOCK MOTOR
LEFT REAR LOCK MOTOR
BACK DOOR LOCK MOTOR
BLU/BLK
POWER WINDOW MASTER SWITCH
BLU/RED
BLU/RED
BLU/RED
WHT/BLK
WHT/BLK
BLK/YEL
BLK
RED
BLK/GRN
BLK/RED
WHT/BLK
RED/BLU
BLK/BLU
BLU/BLK
BLK/BLU
BLU/BLK
RIGHT FRONT WINDOW SWITCH
RIGHT REAR WINDOW SWITCH
LEFT REAR WINDOW SWITCH
RED/GRN (1993-94) RED/BLK (1995-96)
RED/GRN (1993-94) RED/BLK (1995-96)
RED/GRN
RED/GRN
BLK
RED
BLK
RED
BLK
RED
LEFT FRONT DOOR COURTESY SWITCH
TO INTERIOR LIGHTS SYSTEM
RIGHT FRONT DOOR COURTESY SWITCH
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
RIGHT REAR WINDOW MOTOR
LEFT REAR WINDOW MOTOR

86826w21

Fig. 134 Chassis wiring — Land Cruiser 1993-96

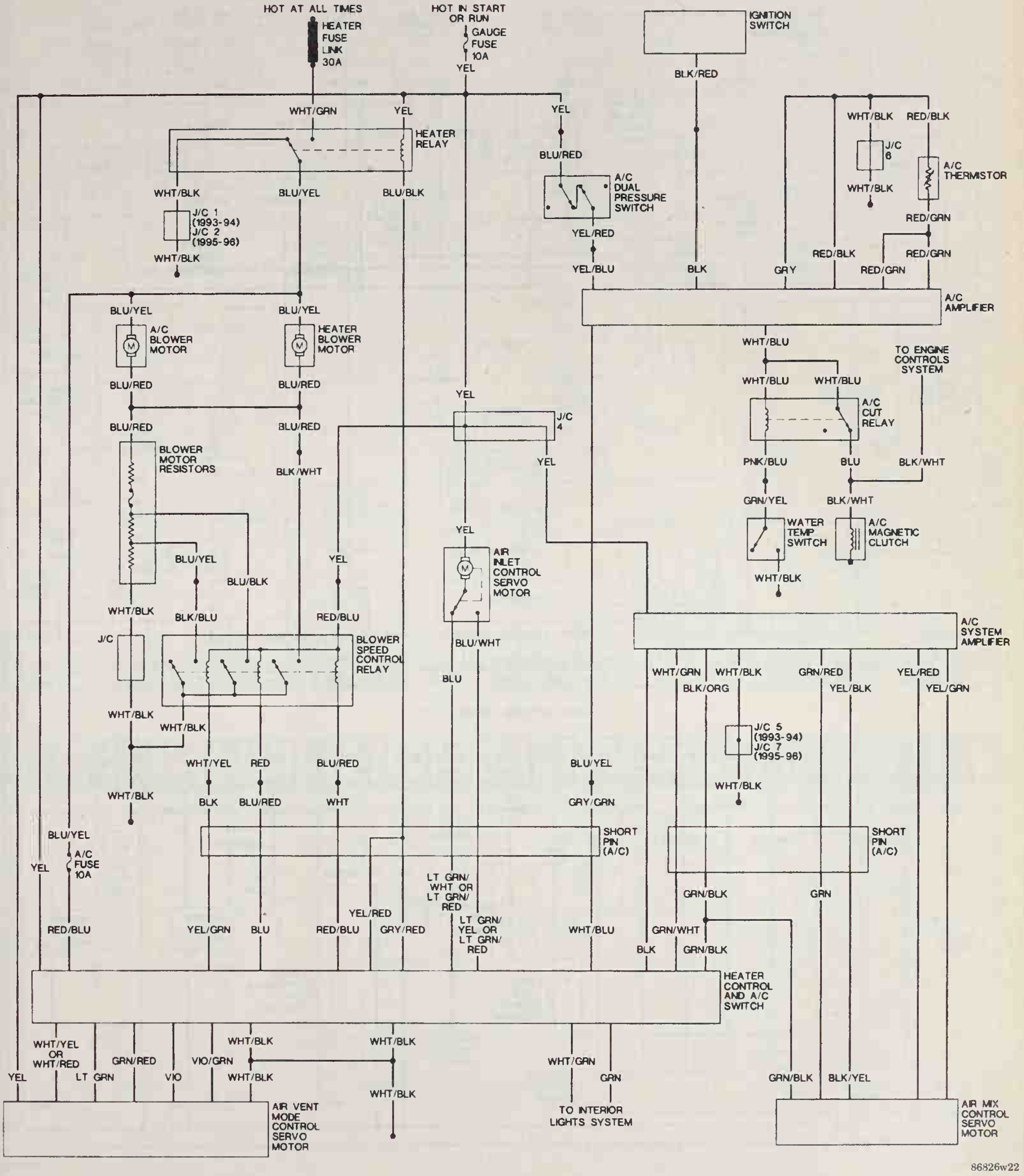

HOT AT ALL TIMES
HEATER FUSE LINK 30A
HOT IN START OR RUN
GAUGE FUSE 10A
YEL
IGNITION SWITCH
BLK/RED
WHT/GRN
YEL
YEL
HEATER RELAY
BLU/RED
A/C DUAL PRESSURE SWITCH
WHT/BLK
RED/BLK
J/C 6
WHT/BLK
A/C THERMISTOR
RED/GRN
WHT/BLK
BLU/YEL
BLU/BLK
J/C 1 (1993-94) J/C 2 (1995-96)
WHT/BLK
YEL/RED
YEL/BLU
BLK
GRY
RED/BLK
RED/GRN
RED/GRN
A/C AMPLIFIER
BLU/YEL
A/C BLOWER MOTOR
BLU/YEL
HEATER BLOWER MOTOR
BLU/RED
BLU/RED
WHT/BLU
TO ENGINE CONTROLS SYSTEM
WHT/BLU
WHT/BLU
A/C CUT RELAY
YEL
J/C 4
BLU/RED
BLOWER MOTOR RESISTORS
BLU/RED
BLK/WHT
YEL
PNK/BLU
BLU
BLK/WHT
GRN/YEL
BLK/WHT
WATER TEMP SWITCH
A/C MAGNETIC CLUTCH
WHT/BLK
YEL
AIR INLET CONTROL SERVO MOTOR
BLU/YEL
BLU/BLK
YEL
WHT/BLK
BLK/BLU
RED/BLU
J/C
BLOWER SPEED CONTROL RELAY
BLU/WHT
BLU
A/C SYSTEM AMPLIFIER
WHT/GRN
WHT/BLK
BLK/ORG
GRN/RED
YEL/BLK
YEL/RED
YEL/GRN
WHT/BLK
WHT/BLK
J/C 5 (1993-94) J/C 7 (1995-96)
WHT/BLK
WHT/YEL
RED
BLU/RED
BLU/YEL
BLK
BLU/RED
WHT
GRY/GRN
WHT/BLK
SHORT PIN (A/C)
SHORT PIN (A/C)
BLU/YEL
A/C FUSE 10A
YEL
LT GRN/ WHT OR LT GRN/ RED
GRN/BLK
GRN
YEL/RED
LT GRN/ YEL OR LT GRN/ RED
RED/BLU
YEL/GRN
BLU
RED/BLU
GRY/RED
WHT/BLU
GRN/WHT
BLK
GRN/BLK
HEATER CONTROL AND A/C SWITCH
WHT/YEL OR WHT/RED
WHT/BLK
WHT/BLK
YEL
LT GRN
GRN/RED
VIO
VIO/GRN
WHT/BLK
WHT/GRN
GRN
GRN/BLK
BLK/YEL
WHT/BLK
AIR VENT MODE CONTROL SERVO MOTOR
TO INTERIOR LIGHTS SYSTEM
AIR MIX CONTROL SERVO MOTOR
86826w22

Fig. 135 Chassis wiring — Land Cruiser 1993-96 continued

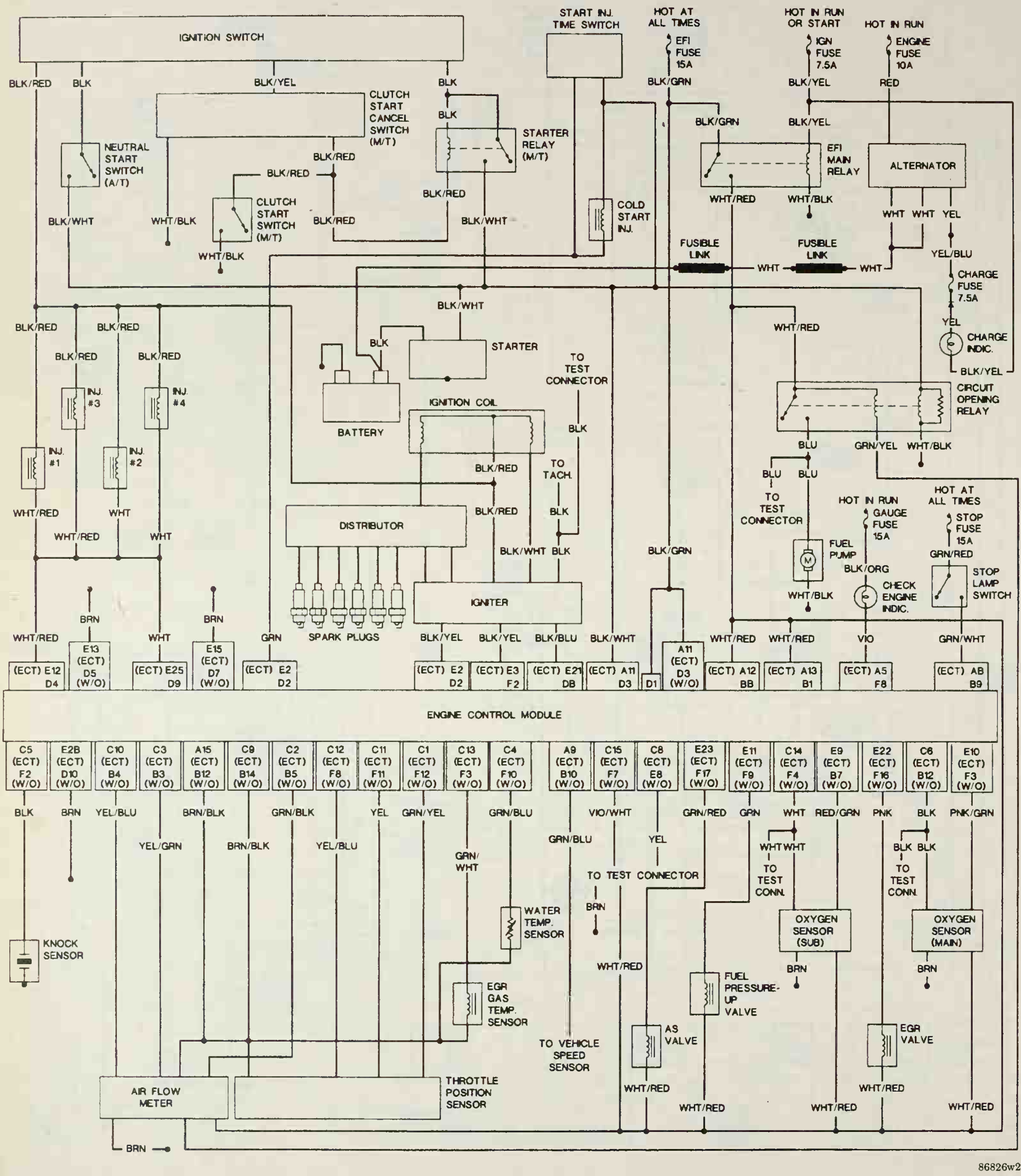

IGNITION SWITCH
BLK/RED
BLK
BLK/YEL
BLK
CLUTCH START CANCEL SWITCH (M/T)
NEUTRAL START SWITCH (A/T)
BLK/RED
CLUTCH START SWITCH (M/T)
STARTER RELAY (M/T)
BLK/WHT
WHT/BLK
WHT/BLK
BLK/RED
BLK/WHT
START INJ. TIME SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
BLK/GRN
COLD START INJ.
HOT IN RUN OR START
IGN FUSE 7.5A
BLK/YEL
HOT IN RUN
ENGINE FUSE 10A
RED
EFI MAIN RELAY
ALTERNATOR
WHT/RED
WHT/BLK
WHT
WHT
YEL
FUSIBLE LINK
FUSIBLE LINK
YEL/BLU
CHARGE FUSE 7.5A
CHARGE INDIC.
BLK/YEL
STARTER
BATTERY
TO TEST CONNECTOR
IGNITION COIL
TO TACH.
CIRCUIT OPENING RELAY
BLU
GRN/YEL
WHT/BLK
TO TEST CONNECTOR
FUEL PUMP
HOT IN RUN
GAUGE FUSE 15A
BLK/ORG
CHECK ENGINE INDIC.
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LAMP SWITCH
INJ. #1
INJ. #2
INJ. #3
INJ. #4
WHT/RED
WHT
DISTRIBUTOR
SPARK PLUGS
IGNITER
BRN
GRN
BLK/YEL
BLK/BLU
VIO
GRN/WHT
(ECT) E12 D4
E13 (ECT) D5 (W/O)
(ECT) E25 D9
E15 (ECT) D7 (W/O)
(ECT) E2 D2
(ECT) E2 D2
(ECT) E3 F2
(ECT) E21 D8
(ECT) A11 D3
D1
A11 (ECT) D3 (W/O)
(ECT) A12 B8
(ECT) A13 B1
(ECT) A5 F8
(ECT) A8 B9
ENGINE CONTROL MODULE
C5 (ECT) F2 (W/O)
E2B (ECT) D10 (W/O)
C10 (ECT) B4 (W/O)
C3 (ECT) B3 (W/O)
A15 (ECT) B12 (W/O)
C9 (ECT) B14 (W/O)
C2 (ECT) B5 (W/O)
C12 (ECT) F8 (W/O)
C11 (ECT) F11 (W/O)
C1 (ECT) F12 (W/O)
C13 (ECT) F3 (W/O)
C4 (ECT) F10 (W/O)
A9 (ECT) B10 (W/O)
C15 (ECT) F7 (W/O)
C8 (ECT) E8 (W/O)
E23 (ECT) F17 (W/O)
E11 (ECT) F9 (W/O)
C14 (ECT) F4 (W/O)
E9 (ECT) B7 (W/O)
E22 (ECT) F16 (W/O)
C6 (ECT) B12 (W/O)
E10 (ECT) F3 (W/O)
BLK
BRN
YEL/BLU
BRN/BLK
GRN/BLK
YEL
GRN/YEL
GRN/BLU
VIO/WHT
GRN/RED
GRN
WHT
RED/GRN
PNK
BLK
PNK/GRN
YEL/GRN
BRN/BLK
YEL/BLU
GRN/WHT
GRN/BLU
YEL
TO TEST CONNECTOR
WHT WHT
TO TEST CONN.
BLK BLK
TO TEST CONN.
KNOCK SENSOR
WATER TEMP. SENSOR
EGR GAS TEMP. SENSOR
OXYGEN SENSOR (SUB)
OXYGEN SENSOR (MAIN)
FUEL PRESSURE-UP VALVE
AS VALVE
EGR VALVE
TO VEHICLE SPEED SENSOR
AIR FLOW METER
THROTTLE POSITION SENSOR
86826w23

Fig. 136 Engine wiring — 22RE 1989-92 4Runner and 1989-90 Pick-Up

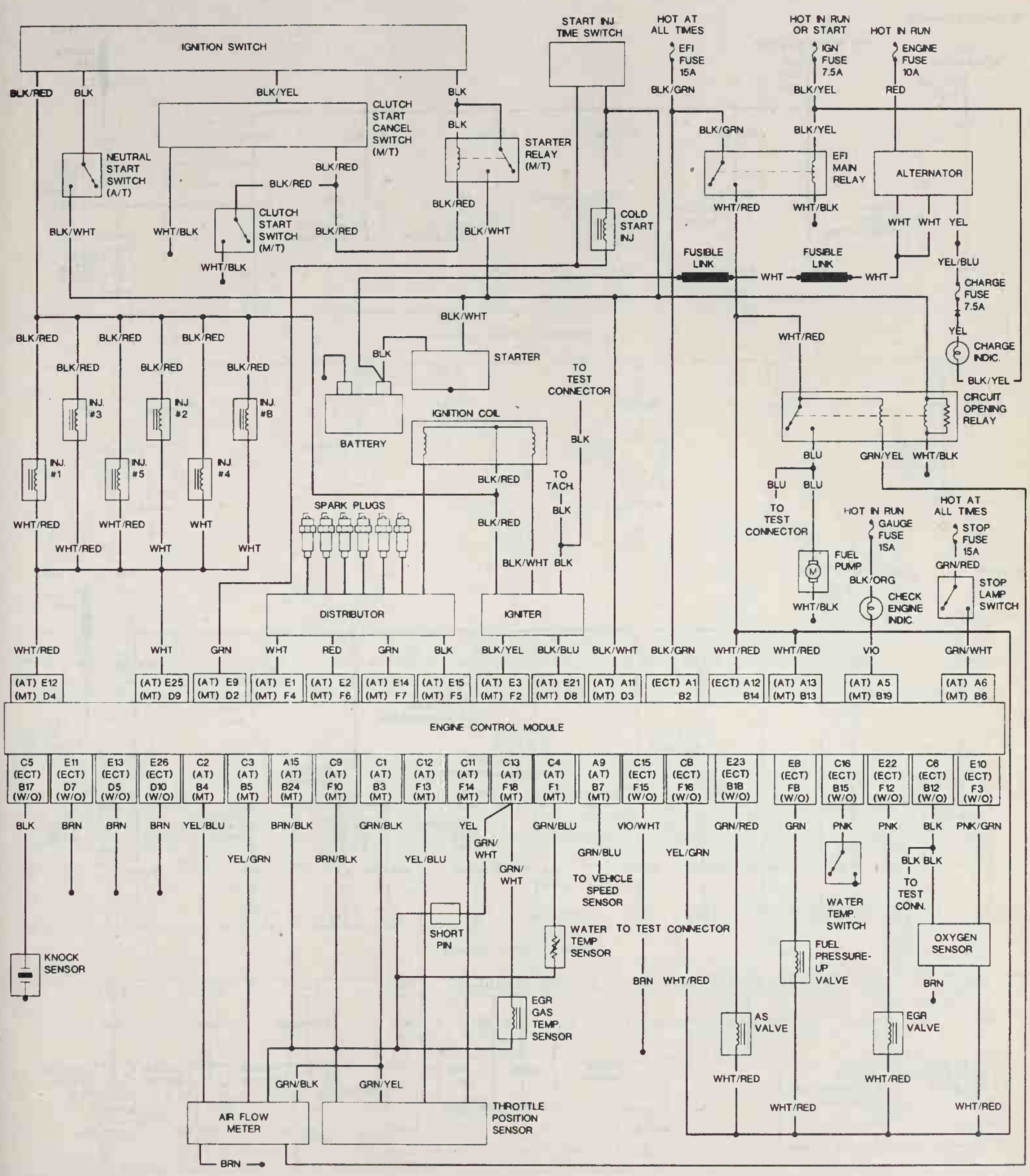

IGNITION SWITCH
BLK/RED
BLK
BLK/YEL
BLK
START INJ TIME SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
BLK/GRN
HOT IN RUN OR START
IGN FUSE 7.5A
BLK/YEL
HOT IN RUN
ENGINE FUSE 10A
RED
CLUTCH START CANCEL SWITCH (M/T)
BLK
STARTER RELAY (M/T)
NEUTRAL START SWITCH (A/T)
BLK/RED
BLK/RED
CLUTCH START SWITCH (M/T)
BLK/RED
BLK/RED
BLK/GRN
BLK/YEL
EFI MAIN RELAY
ALTERNATOR
BLK/WHT
WHT/BLK
WHT/BLK
BLK/WHT
COLD START INJ
WHT/RED
WHT/BLK
WHT
WHT
YEL
FUSIBLE LINK
FUSIBLE LINK
WHT
WHT
YEL/BLU
CHARGE FUSE 7.5A
BLK/WHT
BLK/RED
BLK/RED
BLK/RED
BLK
STARTER
WHT/RED
YEL
CHARGE INDIC.
BLK/RED
BLK/RED
BLK/RED
TO TEST CONNECTOR
BLK/YEL
INJ. #3
INJ. #2
INJ. #8
BATTERY
IGNITION COIL
CIRCUIT OPENING RELAY
BLK
INJ. #1
INJ. #5
INJ. #4
BLK/RED
TO TACH.
BLU
GRN/YEL
WHT/BLK
SPARK PLUGS
BLK
BLU
BLU
WHT/RED
WHT/RED
WHT
BLK/RED
TO TEST CONNECTOR
HOT IN RUN
GAUGE FUSE 15A
HOT AT ALL TIMES
STOP FUSE 15A
WHT/RED
WHT
WHT
BLK/WHT
BLK
FUEL PUMP
GRN/RED
BLK/ORG
STOP LAMP SWITCH
DISTRIBUTOR
IGNITER
WHT/BLK
CHECK ENGINE INDIC.
WHT/RED
WHT
GRN
WHT
RED
GRN
BLK
BLK/YEL
BLK/BLU
BLK/WHT
BLK/GRN
WHT/RED
WHT/RED
VIO
GRN/WHT
(AT) E12 (MT) D4
(AT) E25 (MT) D9
(AT) E9 (MT) D2
(AT) E1 (MT) F4
(AT) E2 (MT) F6
(AT) E14 (MT) F7
(AT) E15 (MT) F5
(AT) E3 (MT) F2
(AT) E21 (MT) D8
(AT) A11 (MT) D3
(ECT) A1 B2
(ECT) A12 B14
(AT) A13 (MT) B13
(AT) A5 (MT) B19
(AT) A6 (MT) B6
ENGINE CONTROL MODULE
C5 (ECT) B17 (W/O)
E11 (ECT) D7 (W/O)
E13 (ECT) D5 (W/O)
E26 (ECT) D10 (W/O)
C2 (AT) B4 (MT)
C3 (AT) B5 (MT)
A15 (AT) B24 (MT)
C9 (AT) F10 (MT)
C1 (AT) B3 (MT)
C12 (AT) F13 (MT)
C11 (AT) F14 (MT)
C13 (AT) F18 (MT)
C4 (AT) F1 (MT)
A9 (AT) B7 (MT)
C15 (ECT) F15 (W/O)
C8 (ECT) F16 (W/O)
E23 (ECT) B18 (W/O)
E8 (ECT) F8 (W/O)
C16 (ECT) B15 (W/O)
E22 (ECT) F12 (W/O)
C6 (ECT) B12 (W/O)
E10 (ECT) F3 (W/O)
BLK
BRN
BRN
BRN
YEL/BLU
BRN/BLK
GRN/BLK
YEL
GRN/BLU
VIO/WHT
GRN/RED
GRN
PNK
PNK
BLK
PNK/GRN
YEL/GRN
BRN/BLK
YEL/BLU
GRN/WHT
GRN/WHT
GRN/BLU
YEL/GRN
BLK BLK
TO VEHICLE SPEED SENSOR
TO TEST CONN.
WATER TEMP. SWITCH
SHORT PIN
KNOCK SENSOR
WATER TEMP SENSOR
TO TEST CONNECTOR
FUEL PRESSURE-UP VALVE
OXYGEN SENSOR
BRN
WHT/RED
BRN
EGR GAS TEMP. SENSOR
AS VALVE
EGR VALVE
WHT/RED
WHT/RED
GRN/BLK
GRN/YEL
WHT/RED
WHT/RED
AIR FLOW METER
THROTTLE POSITION SENSOR
BRN
86826w24

Fig. 137 Engine wiring — 6-cylinder 1989-92 4Runner and 1989-90 Pick-Up

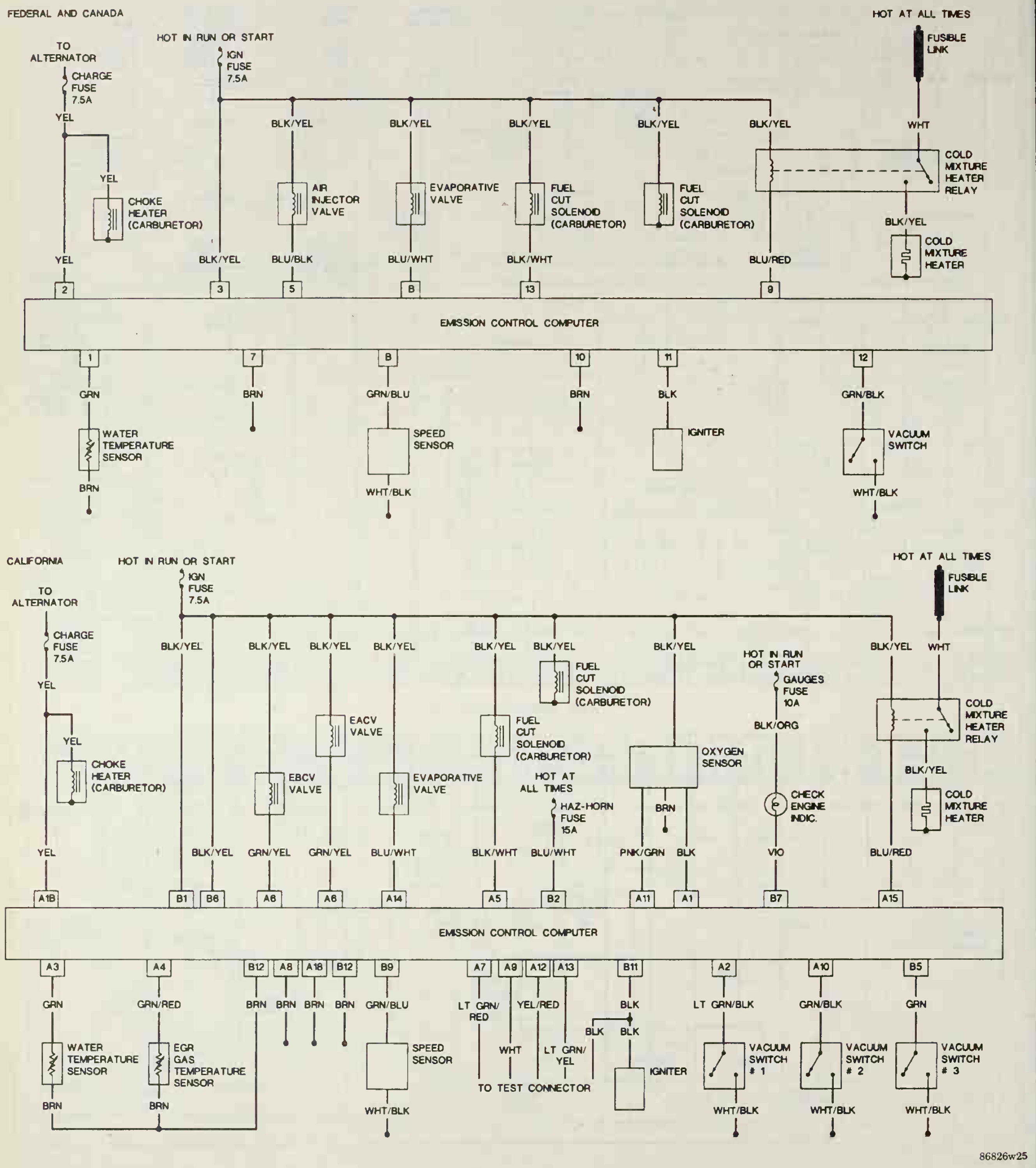

FEDERAL AND CANADA
HOT AT ALL TIMES
FUSIBLE LINK
WHT
TO ALTERNATOR
CHARGE FUSE 7.5A
YEL
YEL
CHOKE HEATER (CARBURETOR)
YEL
HOT IN RUN OR START
IGN FUSE 7.5A
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
AIR INJECTOR VALVE
EVAPORATIVE VALVE
FUEL CUT SOLENOID (CARBURETOR)
FUEL CUT SOLENOID (CARBURETOR)
COLD MIXTURE HEATER RELAY
BLK/YEL
COLD MIXTURE HEATER
BLU/BLK
BLU/WHT
BLK/WHT
BLU/RED
2
3
5
B
13
9
EMISSION CONTROL COMPUTER
1
7
B
10
11
12
GRN
BRN
GRN/BLU
BRN
BLK
GRN/BLK
WATER TEMPERATURE SENSOR
BRN
SPEED SENSOR
WHT/BLK
IGNITER
VACUUM SWITCH
WHT/BLK
CALIFORNIA
HOT IN RUN OR START
IGN FUSE 7.5A
HOT AT ALL TIMES
FUSIBLE LINK
TO ALTERNATOR
CHARGE FUSE 7.5A
YEL
YEL
CHOKE HEATER (CARBURETOR)
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
BLK/YEL
WHT
FUEL CUT SOLENOID (CARBURETOR)
EACV VALVE
FUEL CUT SOLENOID (CARBURETOR)
HOT IN RUN OR START
GAUGES FUSE 10A
BLK/ORG
COLD MIXTURE HEATER RELAY
OXYGEN SENSOR
EBCV VALVE
EVAPORATIVE VALVE
HOT AT ALL TIMES
HAZ-HORN FUSE 15A
BRN
CHECK ENGINE INDIC.
BLK/YEL
COLD MIXTURE HEATER
YEL
BLK/YEL
GRN/YEL
GRN/YEL
BLU/WHT
BLK/WHT
BLU/WHT
PNK/GRN
BLK
VIO
BLU/RED
A18
B1
B6
A6
A6
A14
A5
B2
A11
A1
B7
A15
EMISSION CONTROL COMPUTER
A3
A4
B12
A8
A18
B12
B9
A7
A9
A12
A13
B11
A2
A10
B5
GRN
GRN/RED
BRN
BRN
BRN
BRN
GRN/BLU
LT GRN/ RED
YEL/RED
BLK
LT GRN/BLK
GRN/BLK
GRN
WATER TEMPERATURE SENSOR
EGR GAS TEMPERATURE SENSOR
SPEED SENSOR
WHT
LT GRN/ YEL
BLK
BLK
IGNITER
VACUUM SWITCH # 1
VACUUM SWITCH # 2
VACUUM SWITCH # 3
BRN
BRN
WHT/BLK
TO TEST CONNECTOR
WHT/BLK
WHT/BLK
WHT/BLK
86826w25

Fig. 138 Emissions computer wiring — 1989-90 22R

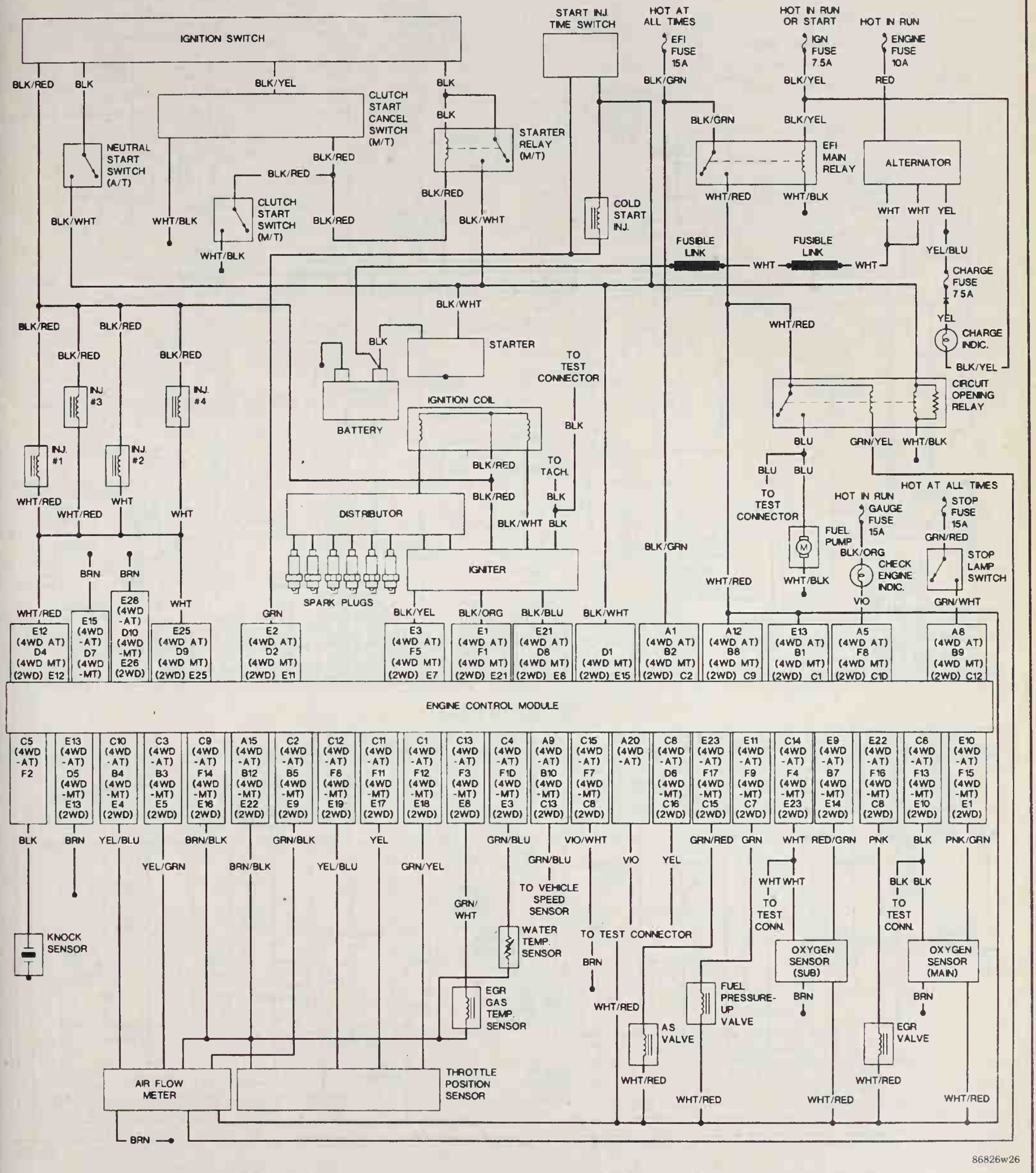

IGNITION SWITCH
START INJ. TIME SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
HOT IN RUN OR START
IGN FUSE 7.5A
HOT IN RUN
ENGINE FUSE 10A
BLK/RED
BLK
BLK/YEL
BLK/GRN
RED
CLUTCH START CANCEL SWITCH (M/T)
NEUTRAL START SWITCH (A/T)
STARTER RELAY (M/T)
EFI MAIN RELAY
ALTERNATOR
CLUTCH START SWITCH (M/T)
COLD START INJ.
BLK/WHT
WHT/BLK
WHT/RED
WHT
YEL
FUSIBLE LINK
YEL/BLU
CHARGE FUSE 7.5A
CHARGE INDIC.
STARTER
BATTERY
TO TEST CONNECTOR
IGNITION COIL
CIRCUIT OPENING RELAY
INJ. #1
INJ. #2
INJ. #3
INJ. #4
TO TACH.
DISTRIBUTOR
IGNITER
SPARK PLUGS
BLU
GRN/YEL
FUEL PUMP
HOT IN RUN
GAUGE FUSE 15A
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LAMP SWITCH
BLK/ORG
CHECK ENGINE INDIC.
VIO
GRN/WHT
BRN
GRN
BLK/BLU
E12 (4WD AT) D4 (4WD MT) (2WD) E12
E15 (4WD -AT) D7 (4WD -MT)
E28 (4WD -AT) D10 (4WD -MT) E26 (2WD)
E25 (4WD AT) D9 (4WD MT) (2WD) E25
E2 (4WD AT) D2 (4WD MT) (2WD) E11
E3 (4WD AT) F5 (4WD MT) (2WD) E7
E1 (4WD AT) F1 (4WD MT) (2WD) E21
E21 (4WD AT) D8 (4WD MT) (2WD) E6
D1 (4WD MT) (2WD) E15
A1 (4WD AT) B2 (4WD MT) (2WD) C2
A12 (4WD AT) B8 (4WD MT) (2WD) C9
E13 (4WD AT) B1 (4WD MT) (2WD) C1
A5 (4WD AT) F8 (4WD MT) (2WD) C10
A8 (4WD AT) B9 (4WD MT) (2WD) C12
ENGINE CONTROL MODULE
C5 (4WD -AT) F2
E13 (4WD -AT) D5 (4WD -MT) E13 (2WD)
C10 (4WD -AT) B4 (4WD -MT) E4 (2WD)
C3 (4WD -AT) B3 (4WD -MT) E5 (2WD)
C9 (4WD -AT) F14 (4WD -MT) E16 (2WD)
A15 (4WD -AT) B12 (4WD -MT) E22 (2WD)
C2 (4WD -AT) B5 (4WD -MT) E9 (2WD)
C12 (4WD -AT) F6 (4WD -MT) E19 (2WD)
C11 (4WD -AT) F11 (4WD -MT) E17 (2WD)
C1 (4WD -AT) F12 (4WD -MT) E18 (2WD)
C13 (4WD -AT) F3 (4WD -MT) E8 (2WD)
C4 (4WD -AT) F10 (4WD -MT) E3 (2WD)
A9 (4WD -AT) B10 (4WD -MT) C13 (2WD)
C15 (4WD -AT) F7 (4WD -MT) C8 (2WD)
A20 (4WD -AT)
C8 (4WD -AT) D6 (4WD -MT) C16 (2WD)
E23 (4WD -AT) F17 (4WD -MT) C15 (2WD)
E11 (4WD -AT) F9 (4WD -MT) C7 (2WD)
C14 (4WD -AT) F4 (4WD -MT) E23 (2WD)
E9 (4WD -AT) B7 (4WD -MT) E14 (2WD)
E22 (4WD -AT) F16 (4WD -MT) C8 (2WD)
C6 (4WD -AT) F13 (4WD -MT) E10 (2WD)
E10 (4WD -AT) F15 (4WD -MT) E1 (2WD)
YEL/BLU
BRN/BLK
GRN/BLK
YEL/GRN
GRN/YEL
GRN/BLU
VIO/WHT
GRN/RED
RED/GRN
PNK
PNK/GRN
KNOCK SENSOR
GRN/ WHT
TO VEHICLE SPEED SENSOR
WATER TEMP. SENSOR
TO TEST CONNECTOR
TO TEST CONN.
OXYGEN SENSOR (SUB)
OXYGEN SENSOR (MAIN)
EGR GAS TEMP. SENSOR
FUEL PRESSURE-UP VALVE
AS VALVE
EGR VALVE
AIR FLOW METER
THROTTLE POSITION SENSOR
86826w26

Fig. 139 Engine wiring — Pick-Up 1991-92 4-cylinder

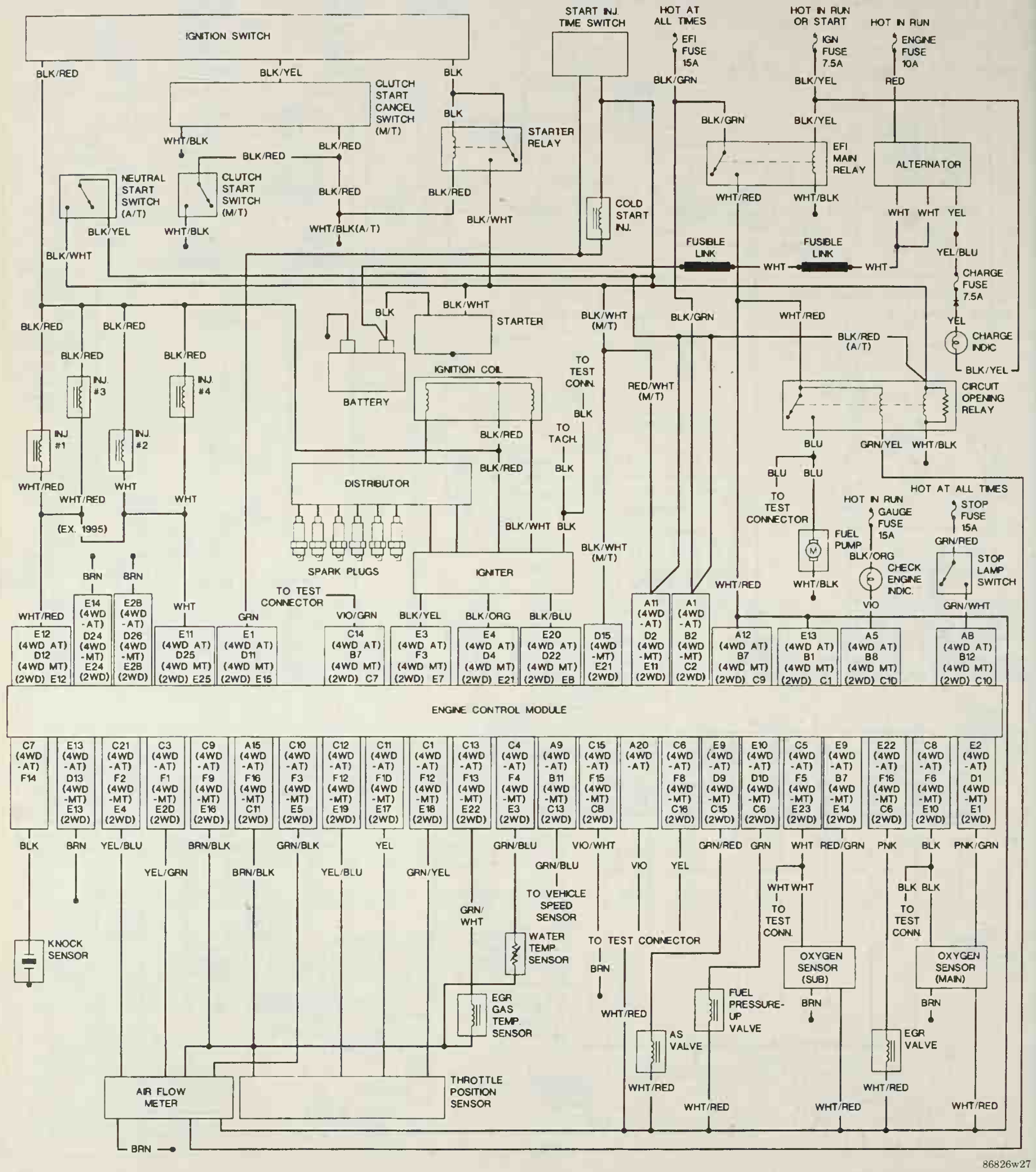
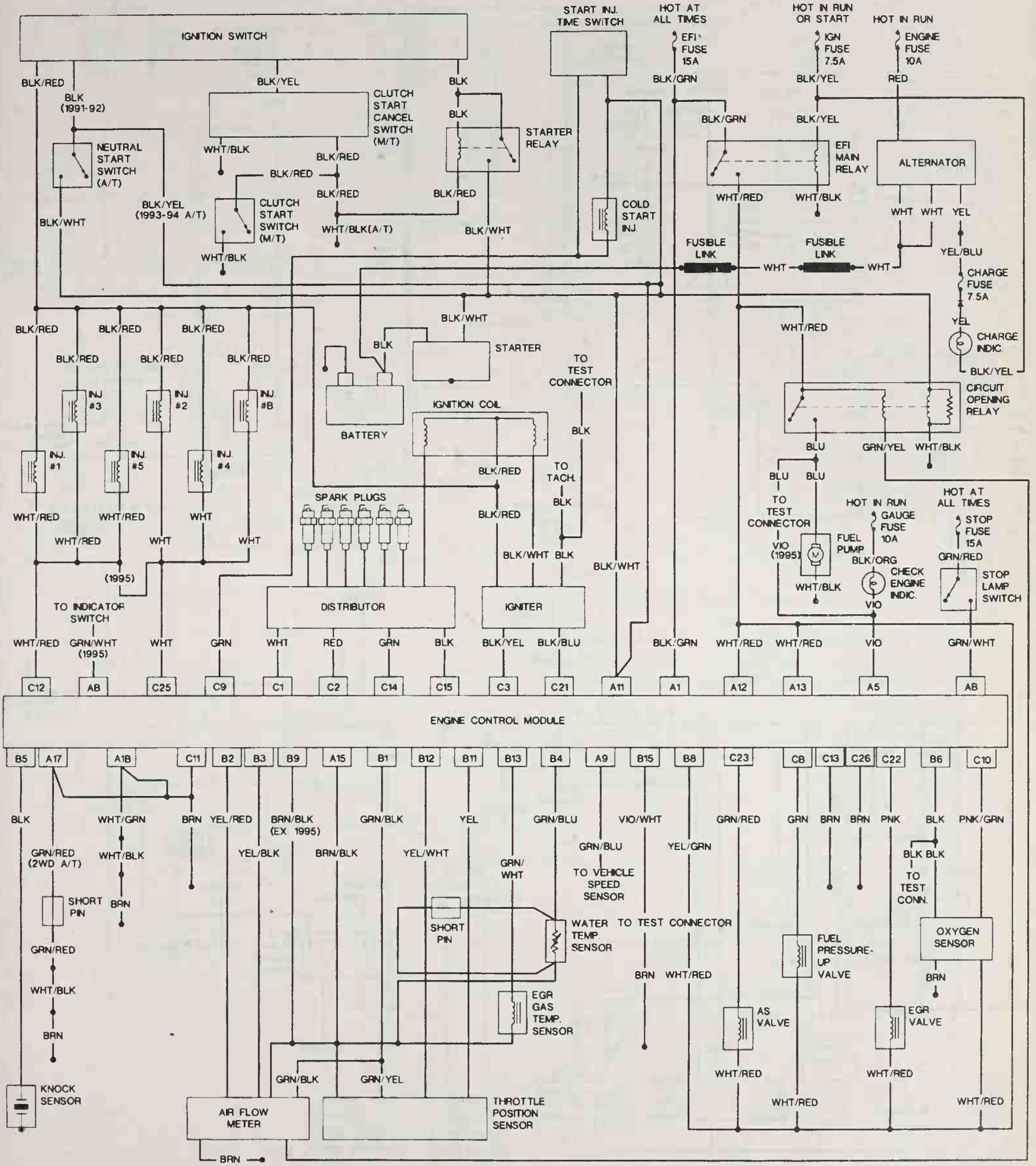

IGNITION SWITCH
BLK/RED
BLK/YEL
BLK
CLUTCH START CANCEL SWITCH (M/T)
START INJ. TIME SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
BLK/GRN
HOT IN RUN OR START
IGN FUSE 7.5A
BLK/YEL
HOT IN RUN
ENGINE FUSE 10A
RED
STARTER RELAY
WHT/BLK
BLK/RED
NEUTRAL START SWITCH (A/T)
CLUTCH START SWITCH (M/T)
WHT/BLK(A/T)
BLK/WHT
COLD START INJ.
EFI MAIN RELAY
WHT/RED
WHT/BLK
ALTERNATOR
WHT
YEL
YEL/BLU
FUSIBLE LINK
CHARGE FUSE 7.5A
CHARGE INDIC
BLK/YEL
BLK/WHT
INJ. #3
INJ. #4
INJ. #1
INJ. #2
BLK
STARTER
BATTERY
BLK/WHT (M/T)
BLK/GRN
BLK/RED (A/T)
TO TEST CONN.
RED/WHT (M/T)
IGNITION COIL
TO TACH.
CIRCUIT OPENING RELAY
BLU
GRN/YEL
WHT/RED
WHT
(EX. 1995)
DISTRIBUTOR
SPARK PLUGS
IGNITER
TO TEST CONNECTOR
FUEL PUMP
HOT IN RUN
GAUGE FUSE 15A
BLK/ORG
CHECK ENGINE INDIC.
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LAMP SWITCH
GRN/WHT
BRN
GRN
VIO/GRN
BLK/YEL
BLK/ORG
BLK/BLU
VIO
E12 (4WD AT) D12 (4WD MT) (2WD) E12
E14 (4WD -AT) D24 (4WD -MT) E24 (2WD)
E28 (4WD -AT) D26 (4WD -MT) E28 (2WD)
E11 (4WD AT) D25 (4WD MT) (2WD) E25
E1 (4WD AT) D11 (4WD MT) (2WD) E15
C14 (4WD AT) B7 (4WD MT) (2WD) C7
E3 (4WD AT) F3 (4WD MT) (2WD) E7
E4 (4WD AT) D4 (4WD MT) (2WD) E21
E20 (4WD AT) D22 (4WD MT) (2WD) EB
D15 (4WD -MT) E21 (2WD)
A11 (4WD -AT) D2 (4WD -MT) E11 (2WD)
A1 (4WD -AT) B2 (4WD -MT) C2 (2WD)
A12 (4WD AT) B7 (4WD MT) (2WD) C9
E13 (4WD AT) B1 (4WD MT) (2WD) C1
A5 (4WD AT) B8 (4WD MT) (2WD) C10
AB (4WD AT) B12 (4WD MT) (2WD) C10
ENGINE CONTROL MODULE
C7 (4WD -AT) F14
E13 (4WD -AT) D13 (4WD -MT) E13 (2WD)
C21 (4WD -AT) F2 (4WD -MT) E4 (2WD)
C3 (4WD -AT) F1 (4WD -MT) E2D (2WD)
C9 (4WD -AT) F9 (4WD -MT) E16 (2WD)
A15 (4WD -AT) F16 (4WD -MT) C11 (2WD)
C10 (4WD -AT) F3 (4WD -MT) E5 (2WD)
C12 (4WD -AT) F12 (4WD -MT) E19 (2WD)
C11 (4WD -AT) F1D (4WD -MT) E17 (2WD)
C1 (4WD -AT) F12 (4WD -MT) E18 (2WD)
C13 (4WD -AT) F13 (4WD -MT) E22 (2WD)
C4 (4WD -AT) F4 (4WD -MT) E3 (2WD)
A9 (4WD -AT) B11 (4WD -MT) C13 (2WD)
C15 (4WD -AT) F15 (4WD -MT) CB (2WD)
A20 (4WD -AT)
C6 (4WD -AT) F8 (4WD -MT) C16 (2WD)
E9 (4WD -AT) D9 (4WD -MT) C15 (2WD)
E10 (4WD -AT) D1D (4WD -MT) C6 (2WD)
C5 (4WD -AT) F5 (4WD -MT) E23 (2WD)
E9 (4WD -AT) B7 (4WD -MT) E14 (2WD)
E22 (4WD -AT) F16 (4WD -MT) C6 (2WD)
C8 (4WD -AT) F6 (4WD -MT) E10 (2WD)
E2 (4WD -AT) D1 (4WD -MT) E1 (2WD)
BLK
BRN
YEL/BLU
YEL/GRN
BRN/BLK
GRN/BLK
YEL
GRN/YEL
GRN/WHT
GRN/BLU
VIO/WHT
GRN/RED
RED/GRN
PNK
PNK/GRN
KNOCK SENSOR
TO VEHICLE SPEED SENSOR
WATER TEMP SENSOR
EGR GAS TEMP. SENSOR
TO TEST CONNECTOR
FUEL PRESSURE-UP VALVE
AS VALVE
OXYGEN SENSOR (SUB)
OXYGEN SENSOR (MAIN)
EGR VALVE
AIR FLOW METER
THROTTLE POSITION SENSOR
86826w27

Fig. 140 Engine wiring — Pick-Up 1993-95 4-cylinder


IGNITION SWITCH
BLK/RED
BLK (1991-92)
BLK/YEL
BLK
CLUTCH START CANCEL SWITCH (M/T)
STARTER RELAY
NEUTRAL START SWITCH (A/T)
WHT/BLK
BLK/RED
BLK/YEL (1993-94 A/T)
CLUTCH START SWITCH (M/T)
WHT/BLK(A/T)
BLK/WHT
START INJ. TIME SWITCH
HOT AT ALL TIMES
EFI FUSE 15A
BLK/GRN
HOT IN RUN OR START
IGN FUSE 7.5A
BLK/YEL
HOT IN RUN
ENGINE FUSE 10A
RED
EFI MAIN RELAY
ALTERNATOR
WHT/RED
WHT/BLK
WHT WHT YEL
COLD START INJ.
FUSIBLE LINK
WHT
YEL/BLU
CHARGE FUSE 7.5A
YEL
CHARGE INDIC.
BLK/YEL
STARTER
BATTERY
INJ. #3
INJ. #2
INJ. #B
INJ. #1
INJ. #5
INJ. #4
WHT/RED
WHT
(1995)
TO INDICATOR SWITCH
IGNITION COIL
SPARK PLUGS
TO TEST CONNECTOR
TO TACH.
BLK/WHT BLK
DISTRIBUTOR
IGNITER
CIRCUIT OPENING RELAY
BLU
GRN/YEL
TO TEST CONNECTOR
VIO (1995)
FUEL PUMP
HOT IN RUN
GAUGE FUSE 10A
BLK/ORG
CHECK ENGINE INDIC.
VIO
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LAMP SWITCH
GRN/WHT (1995)
GRN
RED
BLK/YEL
BLK/BLU
GRN/WHT
C12 AB C25 C9 C1 C2 C14 C15 C3 C21 A11 A1 A12 A13 A5 AB
ENGINE CONTROL MODULE
B5 A17 A18 C11 B2 B3 B9 A15 B1 B12 B11 B13 B4 A9 B15 B8 C23 C8 C13 C26 C22 B6 C10
BLK
WHT/GRN
BRN
YEL/RED
BRN/BLK (EX 1995)
GRN/BLK
YEL
GRN/BLU
VIO/WHT
GRN/RED
GRN BRN BRN PNK
BLK
PNK/GRN
GRN/RED (2WD A/T)
WHT/BLK
YEL/BLK
BRN/BLK
YEL/WHT
GRN/WHT
GRN/BLU
YEL/GRN
BLK BLK
TO TEST CONN.
SHORT PIN
BRN
TO VEHICLE SPEED SENSOR
WATER TEMP. SENSOR
TO TEST CONNECTOR
OXYGEN SENSOR
FUEL PRESSURE-UP VALVE
BRN WHT/RED
EGR GAS TEMP. SENSOR
AS VALVE
EGR VALVE
KNOCK SENSOR
GRN/BLK
GRN/YEL
AIR FLOW METER
THROTTLE POSITION SENSOR
BRN

86826w28

Fig. 141 Engine wiring — Pick-Up 1991-95 6-cylinder

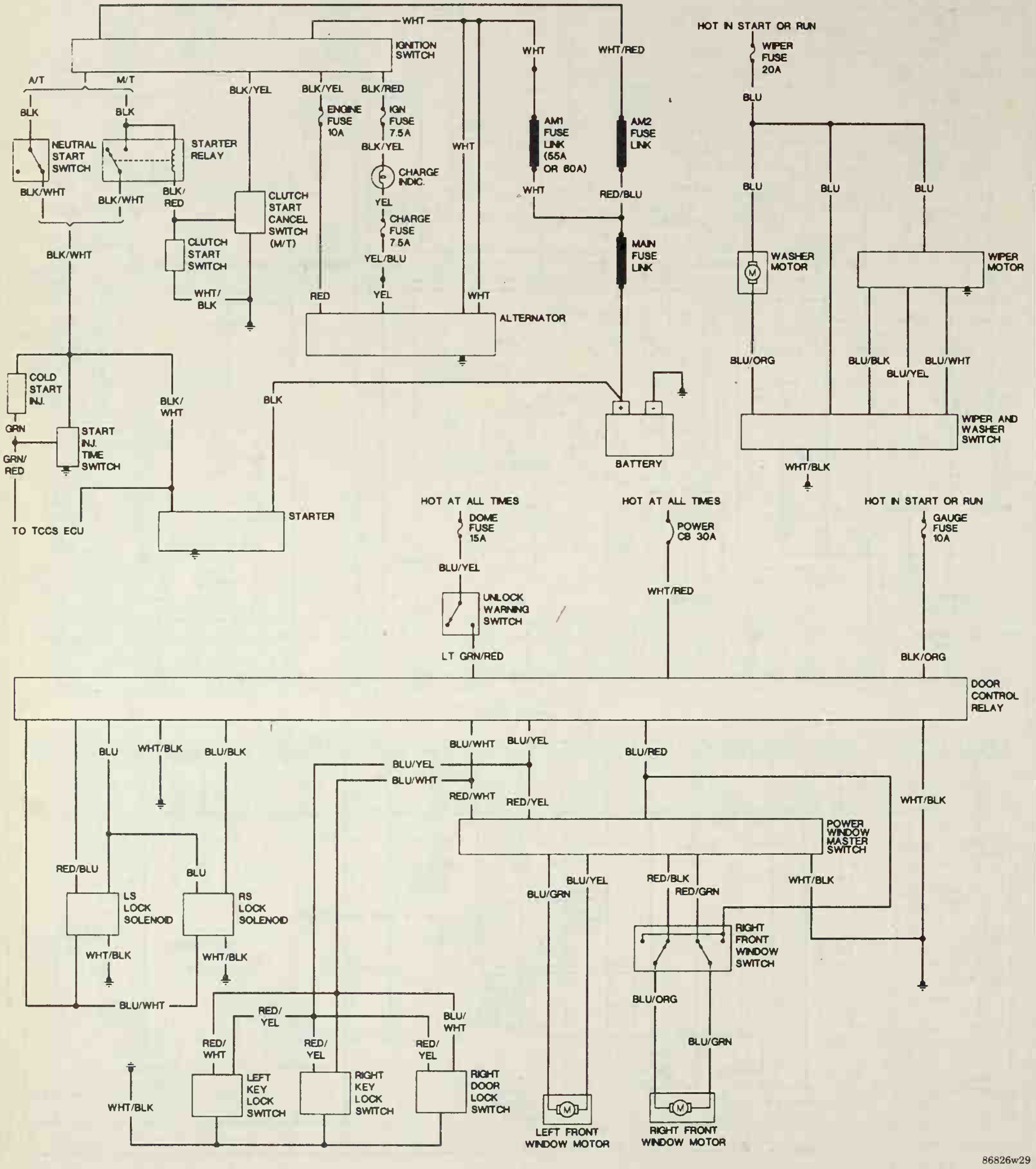

WHT
IGNITION SWITCH
A/T
M/T
BLK
BLK
NEUTRAL START SWITCH
STARTER RELAY
BLK/WHT
BLK/WHT
BLK/RED
BLK/YEL
BLK/YEL
BLK/RED
ENGINE FUSE 10A
IGN FUSE 7.5A
BLK/YEL
CHARGE INDIC.
YEL
CHARGE FUSE 7.5A
YEL/BLU
CLUTCH START CANCEL SWITCH (M/T)
CLUTCH START SWITCH
WHT/BLK
BLK/WHT
RED
YEL
WHT
WHT
ALTERNATOR
WHT
WHT/RED
AM1 FUSE LINK (55A OR 60A)
AM2 FUSE LINK
WHT
RED/BLU
MAIN FUSE LINK
BATTERY
BLK
COLD START INJ.
GRN
GRN/RED
START INJ. TIME SWITCH
BLK/WHT
TO TCCS ECU
STARTER
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
BLU
BLU
WASHER MOTOR
WIPER MOTOR
BLU/ORG
BLU/BLK
BLU/YEL
BLU/WHT
WIPER AND WASHER SWITCH
WHT/BLK
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
LT GRN/RED
HOT AT ALL TIMES
POWER CB 30A
WHT/RED
HOT IN START OR RUN
GAUGE FUSE 10A
BLK/ORG
DOOR CONTROL RELAY
BLU
WHT/BLK
BLU/BLK
BLU/WHT
BLU/YEL
BLU/RED
BLU/YEL
BLU/WHT
RED/WHT
RED/YEL
WHT/BLK
POWER WINDOW MASTER SWITCH
RED/BLU
BLU
LS LOCK SOLENOID
RS LOCK SOLENOID
WHT/BLK
WHT/BLK
BLU/WHT
BLU/YEL
BLU/GRN
RED/BLK
RED/GRN
WHT/BLK
RIGHT FRONT WINDOW SWITCH
BLU/ORG
BLU/GRN
RED/YEL
BLU/WHT
RED/WHT
RED/YEL
RED/YEL
WHT/BLK
LEFT KEY LOCK SWITCH
RIGHT KEY LOCK SWITCH
RIGHT DOOR LOCK SWITCH
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
86826w29

Fig. 142 Chassis wiring — Pick-Up 1989

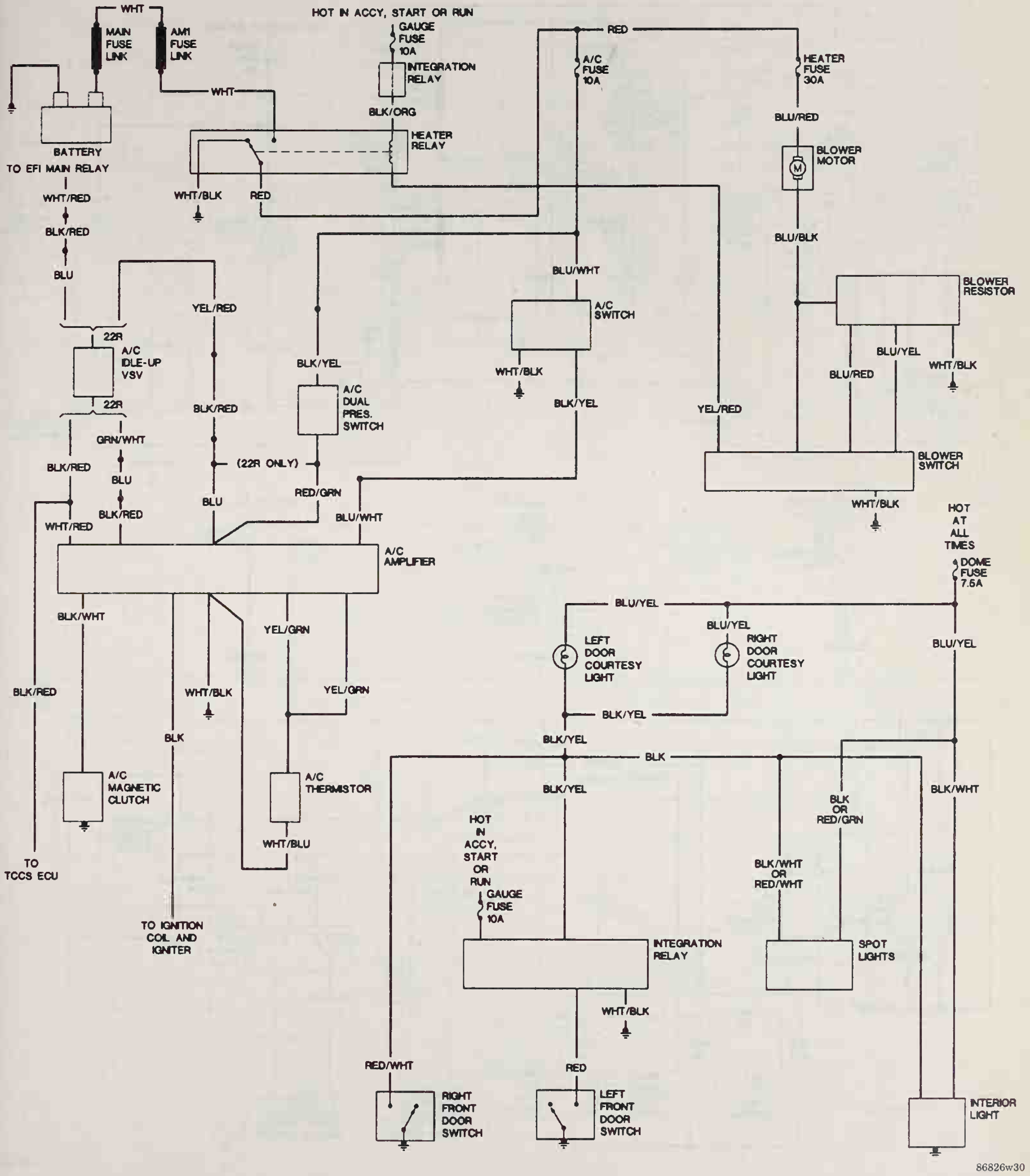

WHT
MAIN FUSE LINK
AM1 FUSE LINK
WHT
BATTERY
TO EFI MAIN RELAY
WHT/RED
BLK/RED
BLU
HOT IN ACCY, START OR RUN
GAUGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
HEATER RELAY
WHT/BLK
RED
RED
A/C FUSE 10A
HEATER FUSE 30A
BLU/RED
BLOWER MOTOR
BLU/BLK
BLOWER RESISTOR
BLU/YEL
BLU/RED
WHT/BLK
BLU/WHT
A/C SWITCH
WHT/BLK
BLK/YEL
YEL/RED
BLOWER SWITCH
WHT/BLK
YEL/RED
22R
A/C IDLE-UP VSV
22R
GRN/WHT
BLU
BLK/RED
BLK/RED
WHT/RED
BLK/RED
BLU
(22R ONLY)
BLK/YEL
A/C DUAL PRES. SWITCH
RED/GRN
BLU/WHT
A/C AMPLIFIER
BLK/WHT
YEL/GRN
YEL/GRN
WHT/BLK
BLK/RED
BLK
A/C MAGNETIC CLUTCH
A/C THERMISTOR
WHT/BLU
TO TCCS ECU
TO IGNITION COIL AND IGNITER
HOT AT ALL TIMES
DOME FUSE 7.5A
BLU/YEL
BLU/YEL
BLU/YEL
LEFT DOOR COURTESY LIGHT
RIGHT DOOR COURTESY LIGHT
BLK/YEL
BLK/YEL
BLK
BLK/YEL
BLK OR RED/GRN
BLK/WHT
HOT IN ACCY, START OR RUN
GAUGE FUSE 10A
BLK/WHT OR RED/WHT
INTEGRATION RELAY
SPOT LIGHTS
WHT/BLK
RED/WHT
RED
RIGHT FRONT DOOR SWITCH
LEFT FRONT DOOR SWITCH
INTERIOR LIGHT
86826w30

Fig. 143 Chassis wiring — Pick-Up 1989 continued

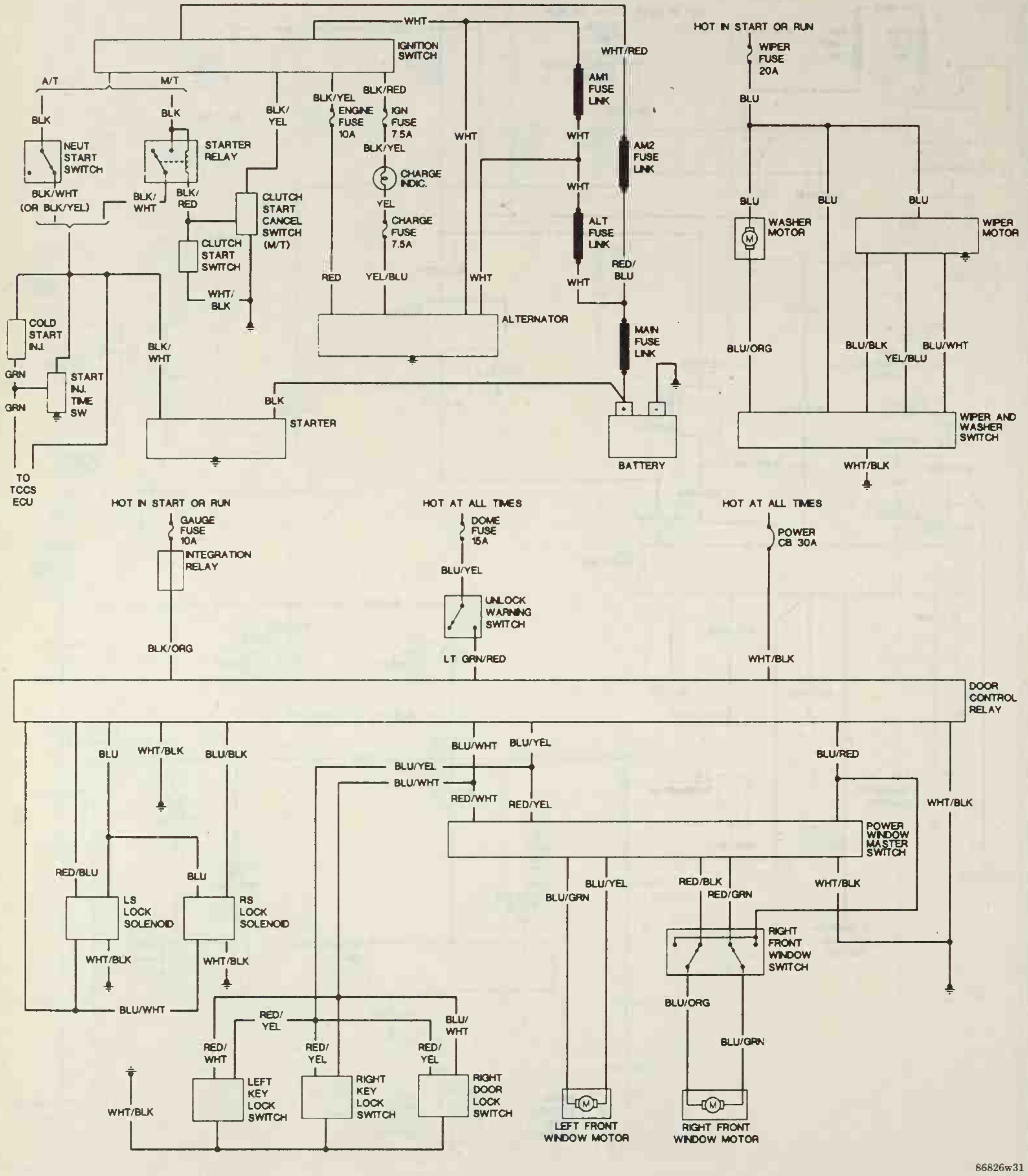

WHT
IGNITION SWITCH
A/T
M/T
BLK
BLK
NEUT START SWITCH
STARTER RELAY
BLK/WHT (OR BLK/YEL)
BLK/WHT
BLK/RED
BLK/YEL
BLK/YEL
ENGINE FUSE 10A
BLK/RED
IGN FUSE 7.5A
BLK/YEL
CHARGE INDIC.
YEL
CHARGE FUSE 7.5A
CLUTCH START CANCEL SWITCH (M/T)
CLUTCH START SWITCH
WHT/BLK
WHT/RED
AM1 FUSE LINK
WHT
WHT
AM2 FUSE LINK
WHT
ALT FUSE LINK
WHT
RED/BLU
WHT
RED
YEL/BLU
WHT
ALTERNATOR
MAIN FUSE LINK
COLD START INJ.
GRN
GRN
START INJ. TIME SW
BLK/WHT
BLK
STARTER
BATTERY
TO TCCS ECU
HOT IN START OR RUN
WIPER FUSE 20A
BLU
BLU
BLU
BLU
WASHER MOTOR
WIPER MOTOR
BLU/ORG
BLU/BLK
BLU/WHT
YEL/BLU
WIPER AND WASHER SWITCH
WHT/BLK
HOT IN START OR RUN
GAUGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
LT GRN/RED
HOT AT ALL TIMES
POWER CB 30A
WHT/BLK
DOOR CONTROL RELAY
BLU
WHT/BLK
BLU/BLK
BLU/WHT
BLU/YEL
BLU/YEL
BLU/WHT
RED/WHT
RED/YEL
BLU/RED
WHT/BLK
POWER WINDOW MASTER SWITCH
RED/BLU
BLU
LS LOCK SOLENOID
RS LOCK SOLENOID
WHT/BLK
WHT/BLK
BLU/WHT
BLU/YEL
BLU/GRN
RED/BLK
RED/GRN
WHT/BLK
RIGHT FRONT WINDOW SWITCH
RED/YEL
BLU/WHT
RED/WHT
RED/YEL
RED/YEL
LEFT KEY LOCK SWITCH
RIGHT KEY LOCK SWITCH
RIGHT DOOR LOCK SWITCH
WHT/BLK
BLU/ORG
BLU/GRN
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
86826w31

Fig. 144 Chassis wiring — Pick-Up 1990-95

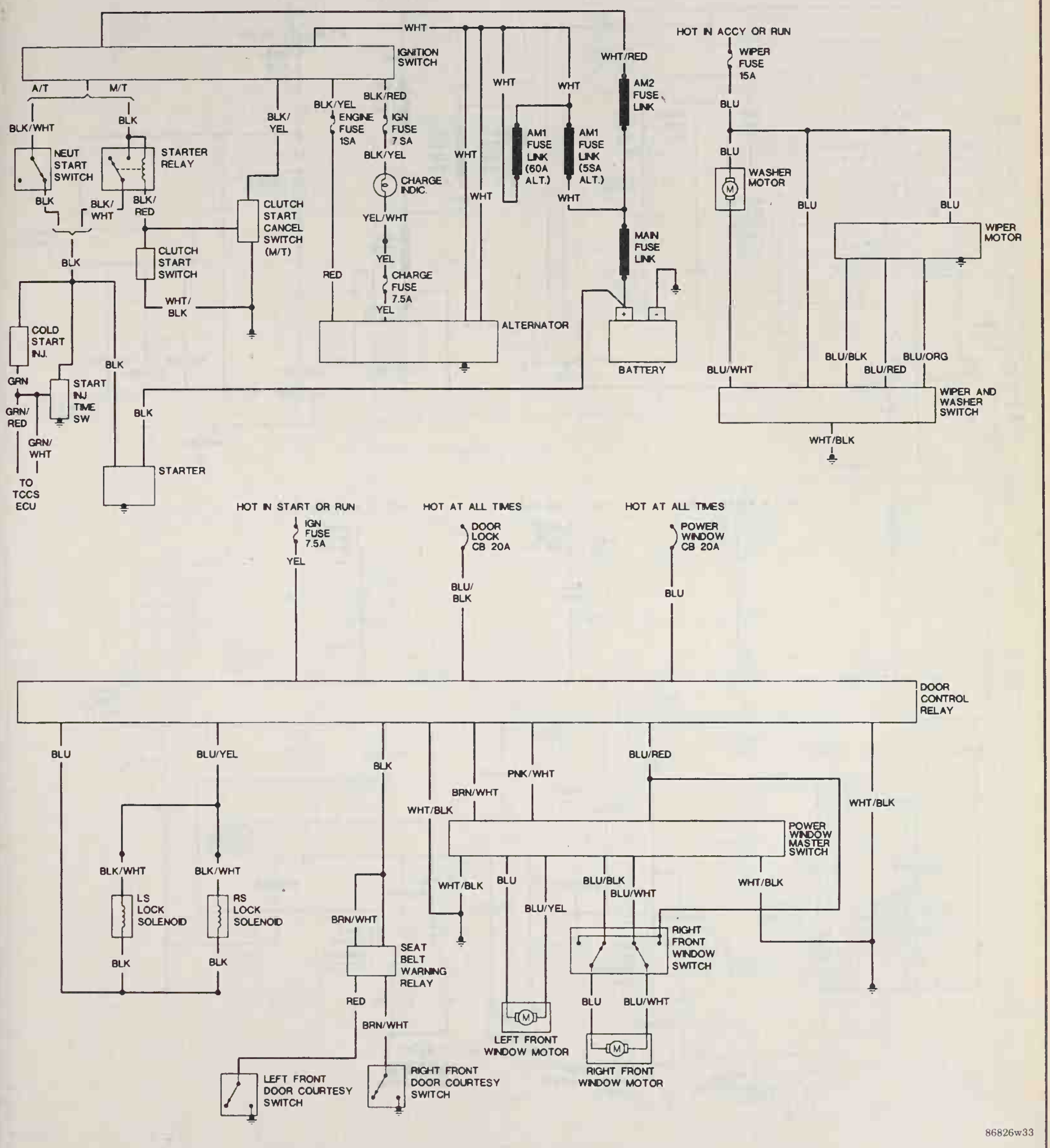

WHT
IGNITION SWITCH
A/T
M/T
BLK/WHT
BLK
NEUT START SWITCH
STARTER RELAY
BLK
BLK/WHT
BLK/RED
BLK
COLD START INJ.
GRN
GRN/RED
START INJ TIME SW
GRN/WHT
TO TCCS ECU
BLK
STARTER
BLK/YEL
CLUTCH START CANCEL SWITCH (M/T)
CLUTCH START SWITCH
WHT/BLK
BLK/YEL
ENGINE FUSE 15A
RED
BLK/RED
IGN FUSE 7.5A
BLK/YEL
CHARGE INDIC.
YEL/WHT
YEL
CHARGE FUSE 7.5A
YEL
ALTERNATOR
WHT
WHT
WHT
WHT
AM1 FUSE LINK (60A ALT.)
AM1 FUSE LINK (55A ALT.)
WHT
WHT/RED
AM2 FUSE LINK
MAIN FUSE LINK
BATTERY
HOT IN ACCY OR RUN
WIPER FUSE 15A
BLU
BLU
WASHER MOTOR
BLU
BLU
WIPER MOTOR
BLU/WHT
BLU/BLK
BLU/RED
BLU/ORG
WIPER AND WASHER SWITCH
WHT/BLK
HOT IN START OR RUN
IGN FUSE 7.5A
YEL
HOT AT ALL TIMES
DOOR LOCK CB 20A
BLU/BLK
HOT AT ALL TIMES
POWER WINDOW CB 20A
BLU
DOOR CONTROL RELAY
BLU
BLU/YEL
BLK
PNK/WHT
BRN/WHT
WHT/BLK
BLU/RED
WHT/BLK
BLK/WHT
BLK/WHT
LS LOCK SOLENOID
RS LOCK SOLENOID
BLK
BLK
BRN/WHT
SEAT BELT WARNING RELAY
RED
BRN/WHT
LEFT FRONT DOOR COURTESY SWITCH
RIGHT FRONT DOOR COURTESY SWITCH
POWER WINDOW MASTER SWITCH
WHT/BLK
BLU
BLU/YEL
LEFT FRONT WINDOW MOTOR
BLU/BLK
BLU/WHT
WHT/BLK
RIGHT FRONT WINDOW SWITCH
BLU
BLU/WHT
RIGHT FRONT WINDOW MOTOR
86826w33

Fig. 145 Chassis wiring — Pick-Up 1990-95 continued

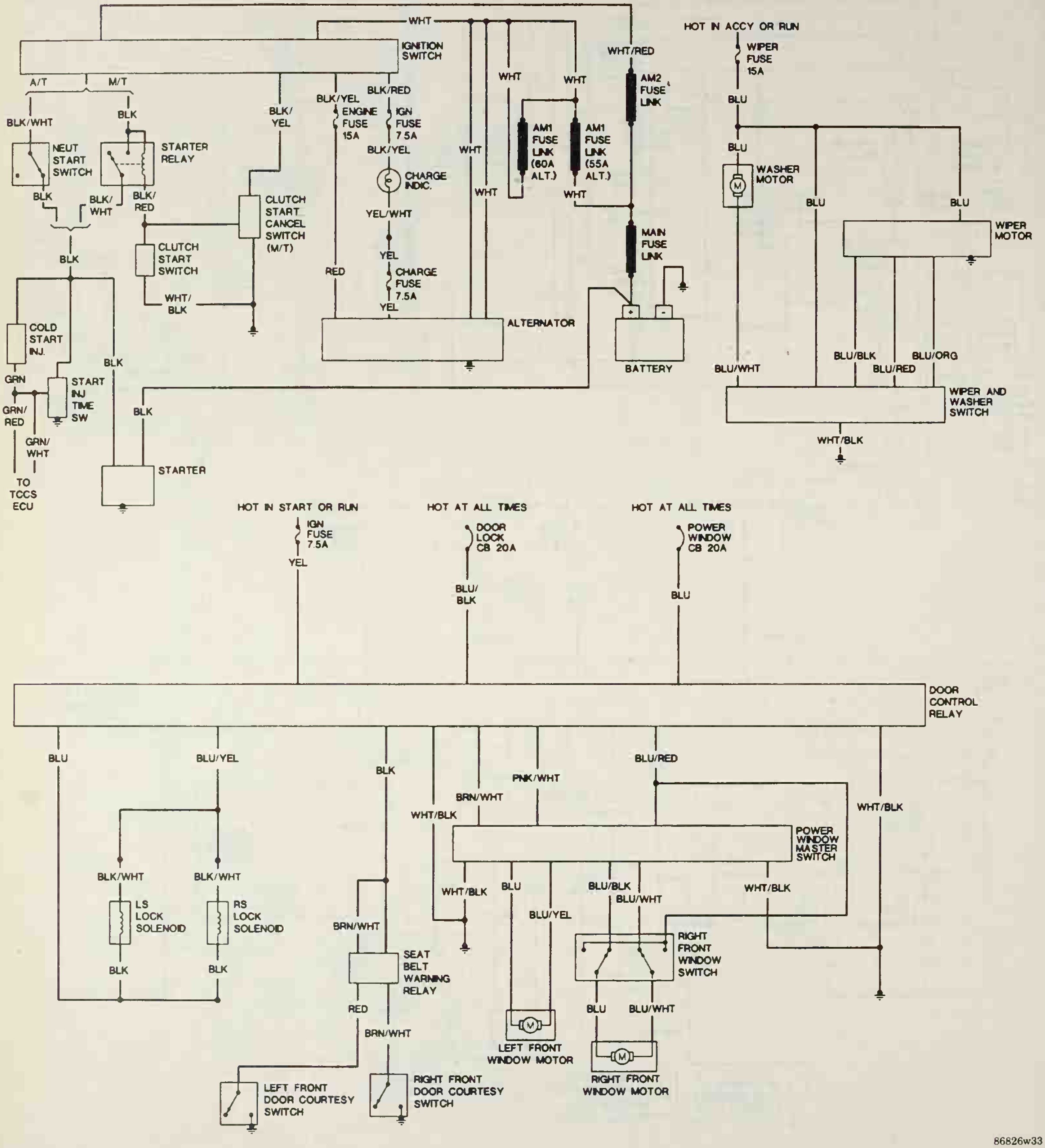

WHT
IGNITION SWITCH
A/T
M/T
BLK/WHT
BLK
NEUT START SWITCH
STARTER RELAY
BLK
BLK/WHT
BLK/RED
BLK
BLK/YEL
CLUTCH START CANCEL SWITCH (M/T)
CLUTCH START SWITCH
WHT/BLK
COLD START INJ.
GRN
GRN/RED
GRN/WHT
START INJ TIME SW
TO TCCS ECU
BLK
BLK
STARTER
BLK/YEL
ENGINE FUSE 15A
BLK/RED
IGN FUSE 7.5A
BLK/YEL
CHARGE INDIC.
YEL/WHT
YEL
CHARGE FUSE 7.5A
YEL
RED
WHT
WHT
WHT
ALTERNATOR
WHT
WHT
AM1 FUSE LINK (60A ALT.)
AM1 FUSE LINK (55A ALT.)
WHT
WHT/RED
AM2 FUSE LINK
MAIN FUSE LINK
BATTERY
HOT IN ACCY OR RUN
WIPER FUSE 15A
BLU
BLU
WASHER MOTOR
BLU
BLU
WIPER MOTOR
BLU/WHT
BLU/BLK
BLU/RED
BLU/ORG
WIPER AND WASHER SWITCH
WHT/BLK
HOT IN START OR RUN
IGN FUSE 7.5A
YEL
HOT AT ALL TIMES
DOOR LOCK CB 20A
BLU/BLK
HOT AT ALL TIMES
POWER WINDOW CB 20A
BLU
DOOR CONTROL RELAY
BLU
BLU/YEL
BLK
PNK/WHT
BRN/WHT
WHT/BLK
BLU/RED
WHT/BLK
POWER WINDOW MASTER SWITCH
BLK/WHT
BLK/WHT
LS LOCK SOLENOID
RS LOCK SOLENOID
BLK
BLK
BRN/WHT
SEAT BELT WARNING RELAY
RED
BRN/WHT
WHT/BLK
BLU
BLU/YEL
BLU/BLK
BLU/WHT
WHT/BLK
RIGHT FRONT WINDOW SWITCH
BLU
BLU/WHT
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW MOTOR
LEFT FRONT DOOR COURTESY SWITCH
RIGHT FRONT DOOR COURTESY SWITCH
86826w33

Fig. 146 Chassis wiring — 4Runner 1989

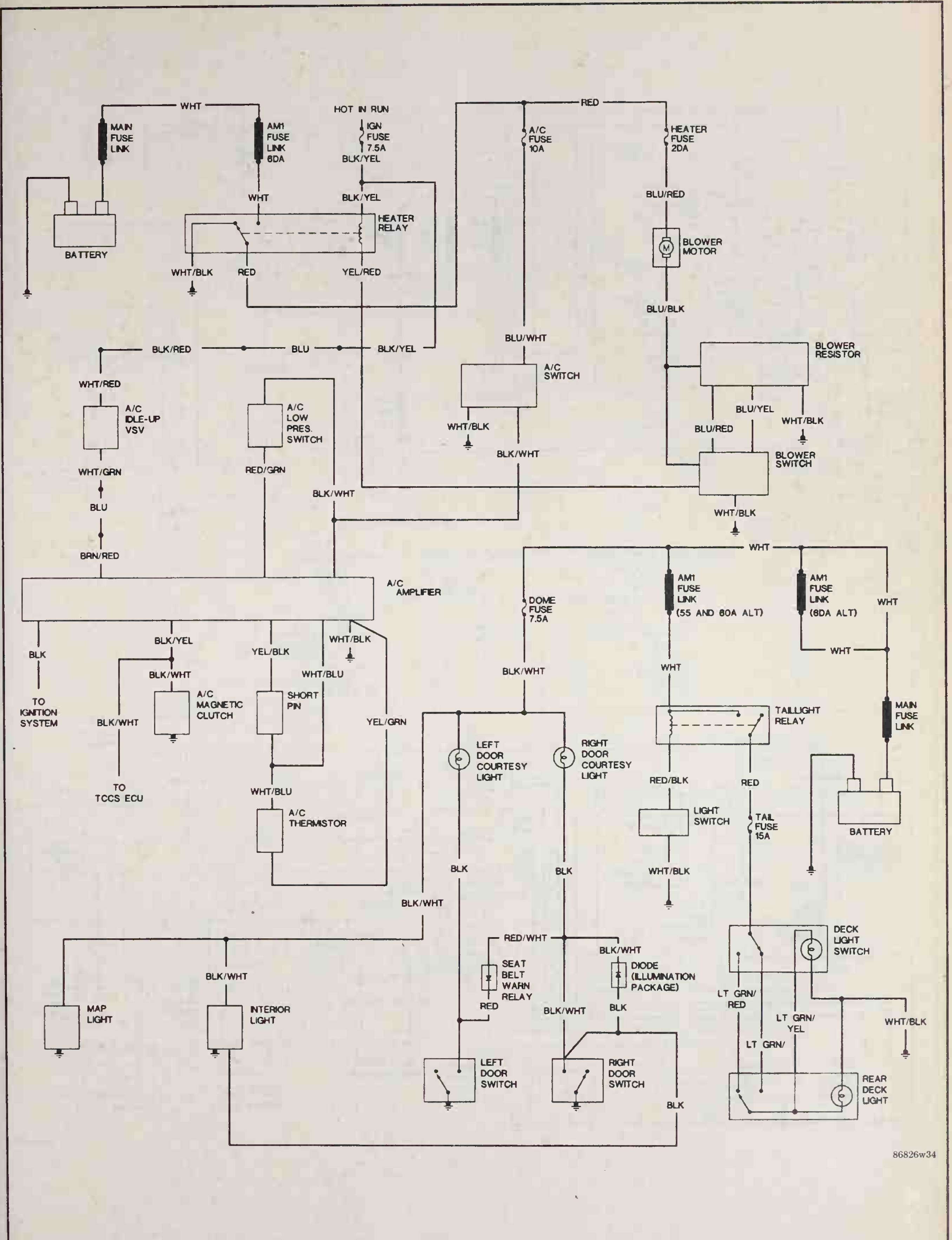

WHT
MAIN FUSE LINK
AM1 FUSE LINK 60A
HOT IN RUN
IGN FUSE 7.5A
BLK/YEL
RED
A/C FUSE 10A
HEATER FUSE 20A
BATTERY
WHT
BLK/YEL
HEATER RELAY
WHT/BLK
RED
YEL/RED
BLU/RED
BLOWER MOTOR
BLU/BLK
BLK/RED
BLU
BLK/YEL
BLU/WHT
A/C SWITCH
BLOWER RESISTOR
WHT/RED
A/C IDLE-UP VSV
A/C LOW PRES. SWITCH
WHT/BLK
BLU/YEL
BLU/RED
WHT/BLK
BLK/WHT
BLOWER SWITCH
WHT/GRN
RED/GRN
BLK/WHT
BLU
WHT/BLK
BRN/RED
WHT
A/C AMPLIFIER
DOME FUSE 7.5A
AM1 FUSE LINK (55 AND 60A ALT)
AM1 FUSE LINK (60A ALT)
WHT
BLK
BLK/YEL
YEL/BLK
WHT/BLK
WHT
BLK/WHT
WHT
BLK/WHT
WHT/BLU
TO IGNITION SYSTEM
BLK/WHT
A/C MAGNETIC CLUTCH
SHORT PIN
YEL/GRN
TAILLIGHT RELAY
MAIN FUSE LINK
LEFT DOOR COURTESY LIGHT
RIGHT DOOR COURTESY LIGHT
TO TCCS ECU
WHT/BLU
RED/BLK
RED
A/C THERMISTOR
LIGHT SWITCH
TAIL FUSE 15A
BATTERY
BLK
BLK
WHT/BLK
BLK/WHT
RED/WHT
DECK LIGHT SWITCH
BLK/WHT
SEAT BELT WARN RELAY
DIODE (ILLUMINATION PACKAGE)
BLK/WHT
LT GRN/RED
RED
BLK/WHT
BLK
LT GRN/YEL
WHT/BLK
MAP LIGHT
INTERIOR LIGHT
LT GRN/
LEFT DOOR SWITCH
RIGHT DOOR SWITCH
REAR DECK LIGHT
BLK
86826w34

Fig. 147 Chassis wiring — 4Runner 1989 continued

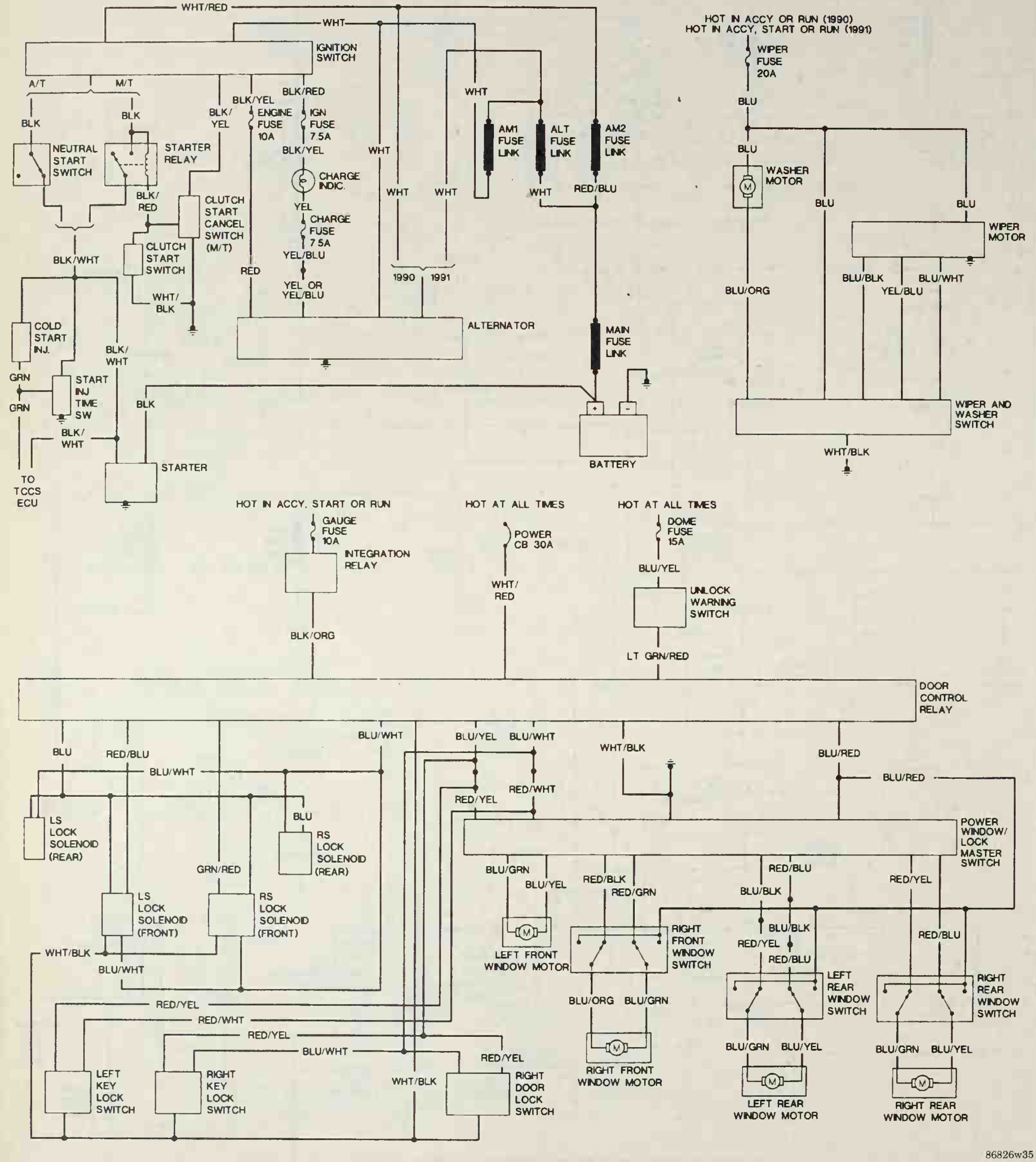

WHT/RED
WHT
IGNITION SWITCH
A/T
M/T
BLK
BLK
NEUTRAL START SWITCH
STARTER RELAY
BLK/YEL
BLK/RED
BLK/ YEL
ENGINE FUSE 10A
IGN FUSE 7.5A
BLK/YEL
WHT
WHT
CHARGE INDIC.
YEL
CHARGE FUSE 7.5A
YEL/BLU
YEL OR YEL/BLU
BLK/ RED
CLUTCH START CANCEL SWITCH (M/T)
CLUTCH START SWITCH
BLK/WHT
RED
WHT/ BLK
WHT
WHT
1990
1991
AM1 FUSE LINK
ALT FUSE LINK
AM2 FUSE LINK
WHT
RED/BLU
ALTERNATOR
MAIN FUSE LINK
COLD START INJ.
BLK/ WHT
GRN
START INJ TIME SW
GRN
BLK/ WHT
BLK
TO TCCS ECU
STARTER
BATTERY
HOT IN ACCY OR RUN (1990)
HOT IN ACCY, START OR RUN (1991)
WIPER FUSE 20A
BLU
BLU
WASHER MOTOR
BLU
BLU
WIPER MOTOR
BLU/ORG
BLU/BLK
BLU/WHT
YEL/BLU
WIPER AND WASHER SWITCH
WHT/BLK
HOT IN ACCY, START OR RUN
GAUGE FUSE 10A
INTEGRATION RELAY
BLK/ORG
HOT AT ALL TIMES
POWER CB 30A
WHT/ RED
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
LT GRN/RED
DOOR CONTROL RELAY
BLU
RED/BLU
BLU/WHT
BLU/WHT
BLU/YEL
BLU/WHT
WHT/BLK
BLU/RED
BLU/RED
LS LOCK SOLENOID (REAR)
BLU
RS LOCK SOLENOID (REAR)
RED/WHT
RED/YEL
POWER WINDOW/ LOCK MASTER SWITCH
GRN/RED
LS LOCK SOLENOID (FRONT)
RS LOCK SOLENOID (FRONT)
BLU/GRN
BLU/YEL
RED/BLK
RED/GRN
RED/BLU
RED/YEL
BLU/BLK
BLU/BLK
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW SWITCH
RED/YEL
RED/BLU
RED/BLU
WHT/BLK
BLU/WHT
LEFT REAR WINDOW SWITCH
RIGHT REAR WINDOW SWITCH
RED/YEL
RED/WHT
BLU/ORG
BLU/GRN
RED/YEL
RIGHT FRONT WINDOW MOTOR
BLU/WHT
BLU/GRN
BLU/YEL
BLU/GRN
BLU/YEL
RED/YEL
LEFT KEY LOCK SWITCH
RIGHT KEY LOCK SWITCH
WHT/BLK
RIGHT DOOR LOCK SWITCH
LEFT REAR WINDOW MOTOR
RIGHT REAR WINDOW MOTOR
86826w35

Fig. 148 Chassis wiring — 4Runner 1990-91

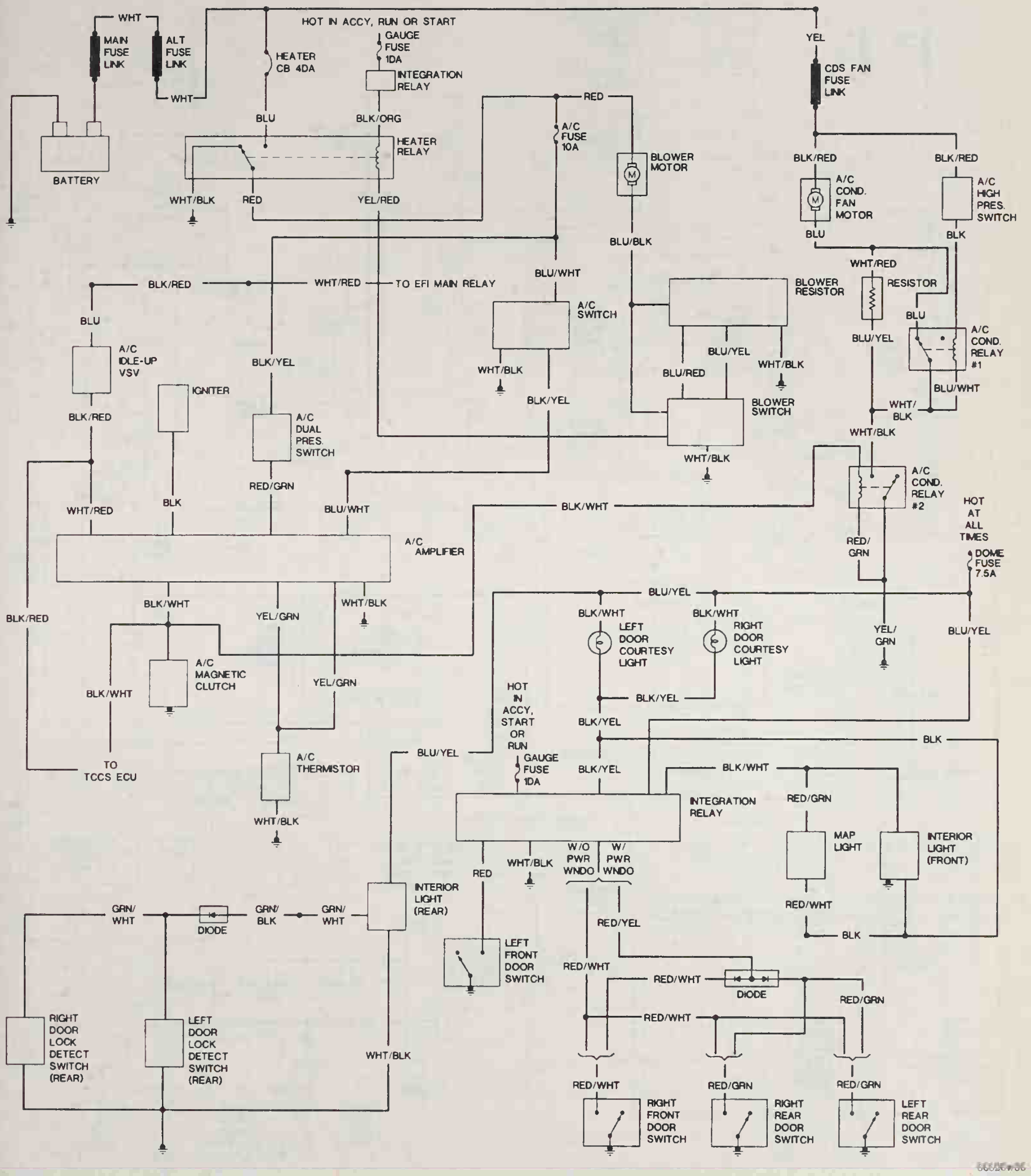

WHT
MAIN FUSE LINK
ALT FUSE LINK
WHT
BATTERY
HOT IN ACCY, RUN OR START
HEATER CB 4DA
GAUGE FUSE 1DA
INTEGRATION RELAY
BLU
BLK/ORG
HEATER RELAY
WHT/BLK
RED
YEL/RED
RED
A/C FUSE 10A
BLOWER MOTOR
YEL
CDS FAN FUSE LINK
BLK/RED
A/C COND. FAN MOTOR
BLU
BLK/RED
A/C HIGH PRES. SWITCH
BLK
BLU/BLK
WHT/RED
RESISTOR
BLK/RED
WHT/RED
TO EFI MAIN RELAY
BLU/WHT
A/C SWITCH
BLOWER RESISTOR
BLU
BLU
A/C IDLE-UP VSV
BLU/YEL
A/C COND. RELAY #1
BLK/YEL
WHT/BLK
BLU/YEL
WHT/BLK
BLU/RED
BLU/WHT
IGNITER
BLK/RED
A/C DUAL PRES. SWITCH
BLK/YEL
BLOWER SWITCH
WHT/ BLK
WHT/BLK
WHT/BLK
RED/GRN
A/C COND. RELAY #2
WHT/RED
BLK
BLU/WHT
BLK/WHT
HOT AT ALL TIMES
A/C AMPLIFIER
RED/ GRN
DOME FUSE 7.5A
BLK/RED
BLK/WHT
YEL/GRN
WHT/BLK
BLU/YEL
BLK/WHT
BLK/WHT
LEFT DOOR COURTESY LIGHT
RIGHT DOOR COURTESY LIGHT
YEL/ GRN
BLU/YEL
A/C MAGNETIC CLUTCH
BLK/WHT
YEL/GRN
HOT IN ACCY, START OR RUN
BLK/YEL
BLK/YEL
BLK
TO TCCS ECU
A/C THERMISTOR
BLU/YEL
GAUGE FUSE 1DA
BLK/YEL
BLK/WHT
INTEGRATION RELAY
RED/GRN
WHT/BLK
MAP LIGHT
INTERIOR LIGHT (FRONT)
RED
WHT/BLK
W/O PWR WNDO
W/ PWR WNDO
GRN/ WHT
DIODE
GRN/ BLK
GRN/ WHT
INTERIOR LIGHT (REAR)
RED/WHT
BLK
RED/YEL
LEFT FRONT DOOR SWITCH
RED/WHT
RED/WHT
DIODE
RED/GRN
RED/WHT
RIGHT DOOR LOCK DETECT SWITCH (REAR)
LEFT DOOR LOCK DETECT SWITCH (REAR)
WHT/BLK
RED/WHT
RED/GRN
RED/GRN
RIGHT FRONT DOOR SWITCH
RIGHT REAR DOOR SWITCH
LEFT REAR DOOR SWITCH
88086w36

Fig. 149 Chassis wiring — 4Runner 1990 continued

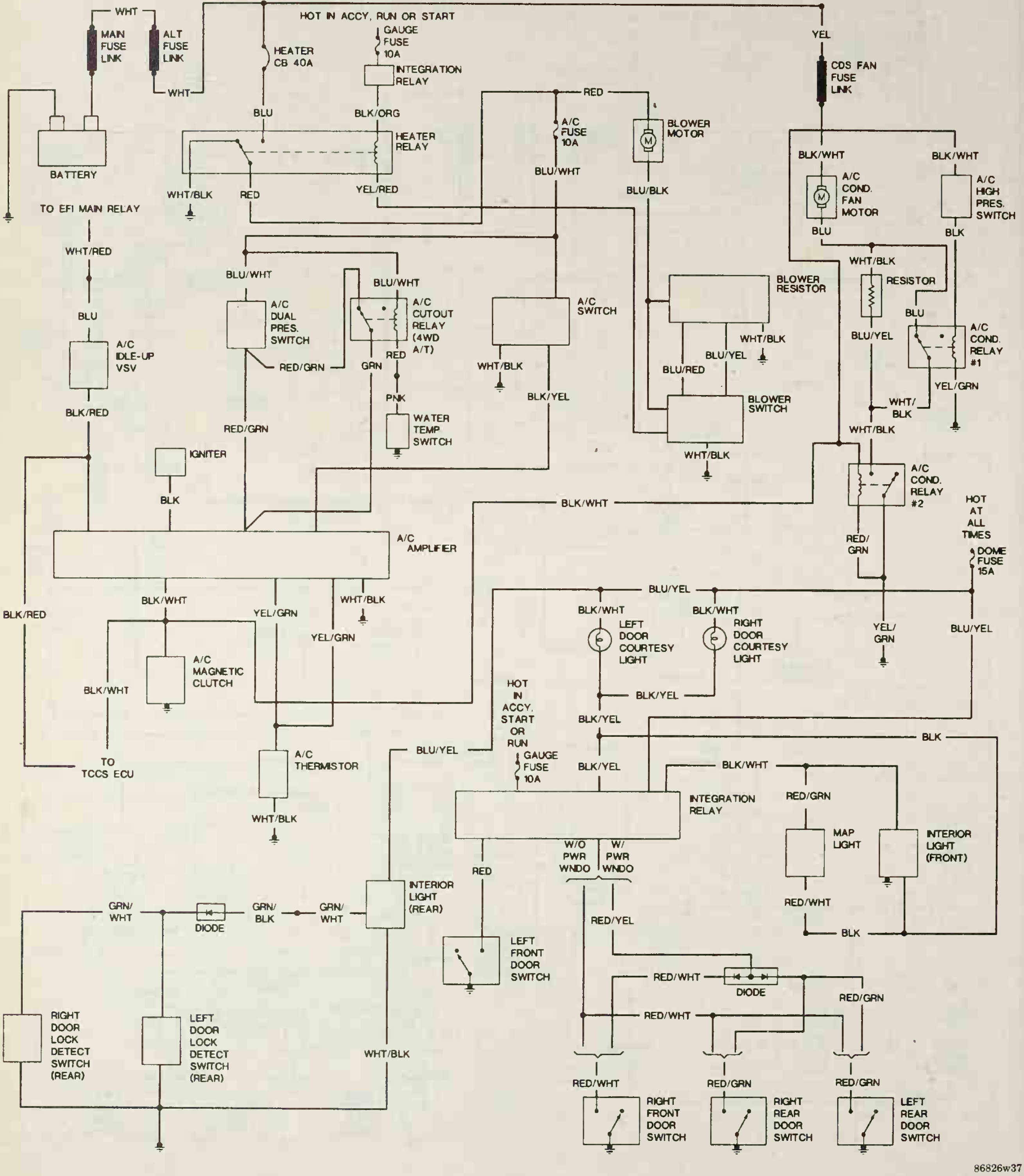

WHT
MAIN FUSE LINK
ALT FUSE LINK
WHT
BATTERY
HOT IN ACCY, RUN OR START
GAUGE FUSE 10A
INTEGRATION RELAY
HEATER CB 40A
BLU
BLK/ORG
HEATER RELAY
WHT/BLK
RED
YEL/RED
TO EFI MAIN RELAY
WHT/RED
BLU
A/C IDLE-UP VSV
BLK/RED
RED
A/C FUSE 10A
BLU/WHT
BLOWER MOTOR
BLU/BLK
YEL
CDS FAN FUSE LINK
BLK/WHT
BLK/WHT
A/C COND. FAN MOTOR
A/C HIGH PRES. SWITCH
BLU
BLK
WHT/BLK
RESISTOR
BLU/WHT
A/C DUAL PRES. SWITCH
BLU/WHT
A/C CUTOUT RELAY (4WD A/T)
RED
RED/GRN
GRN
PNK
WATER TEMP SWITCH
A/C SWITCH
WHT/BLK
BLK/YEL
BLOWER RESISTOR
WHT/BLK
BLU/YEL
BLU/RED
BLOWER SWITCH
WHT/BLK
BLU
BLU/YEL
A/C COND. RELAY #1
YEL/GRN
WHT/ BLK
WHT/BLK
RED/GRN
IGNITER
BLK
BLK/WHT
A/C AMPLIFIER
A/C COND. RELAY #2
HOT AT ALL TIMES
DOME FUSE 15A
RED/ GRN
BLK/RED
BLK/WHT
YEL/GRN
WHT/BLK
YEL/GRN
BLU/YEL
BLK/WHT
BLK/WHT
LEFT DOOR COURTESY LIGHT
RIGHT DOOR COURTESY LIGHT
YEL/ GRN
BLU/YEL
A/C MAGNETIC CLUTCH
BLK/WHT
BLK/YEL
HOT IN ACCY, START OR RUN
BLK/YEL
BLK
TO TCCS ECU
A/C THERMISTOR
BLU/YEL
GAUGE FUSE 10A
BLK/YEL
BLK/WHT
INTEGRATION RELAY
RED/GRN
MAP LIGHT
INTERIOR LIGHT (FRONT)
WHT/BLK
W/O PWR WNDO
W/ PWR WNDO
RED
RED/WHT
GRN/ WHT
DIODE
GRN/ BLK
GRN/ WHT
INTERIOR LIGHT (REAR)
LEFT FRONT DOOR SWITCH
RED/YEL
BLK
RED/WHT
DIODE
RED/GRN
RED/WHT
RIGHT DOOR LOCK DETECT SWITCH (REAR)
LEFT DOOR LOCK DETECT SWITCH (REAR)
WHT/BLK
RED/WHT
RED/GRN
RED/GRN
RIGHT FRONT DOOR SWITCH
RIGHT REAR DOOR SWITCH
LEFT REAR DOOR SWITCH
86826w37

Fig. 150 Chassis wiring — 4Runner 1991 continued

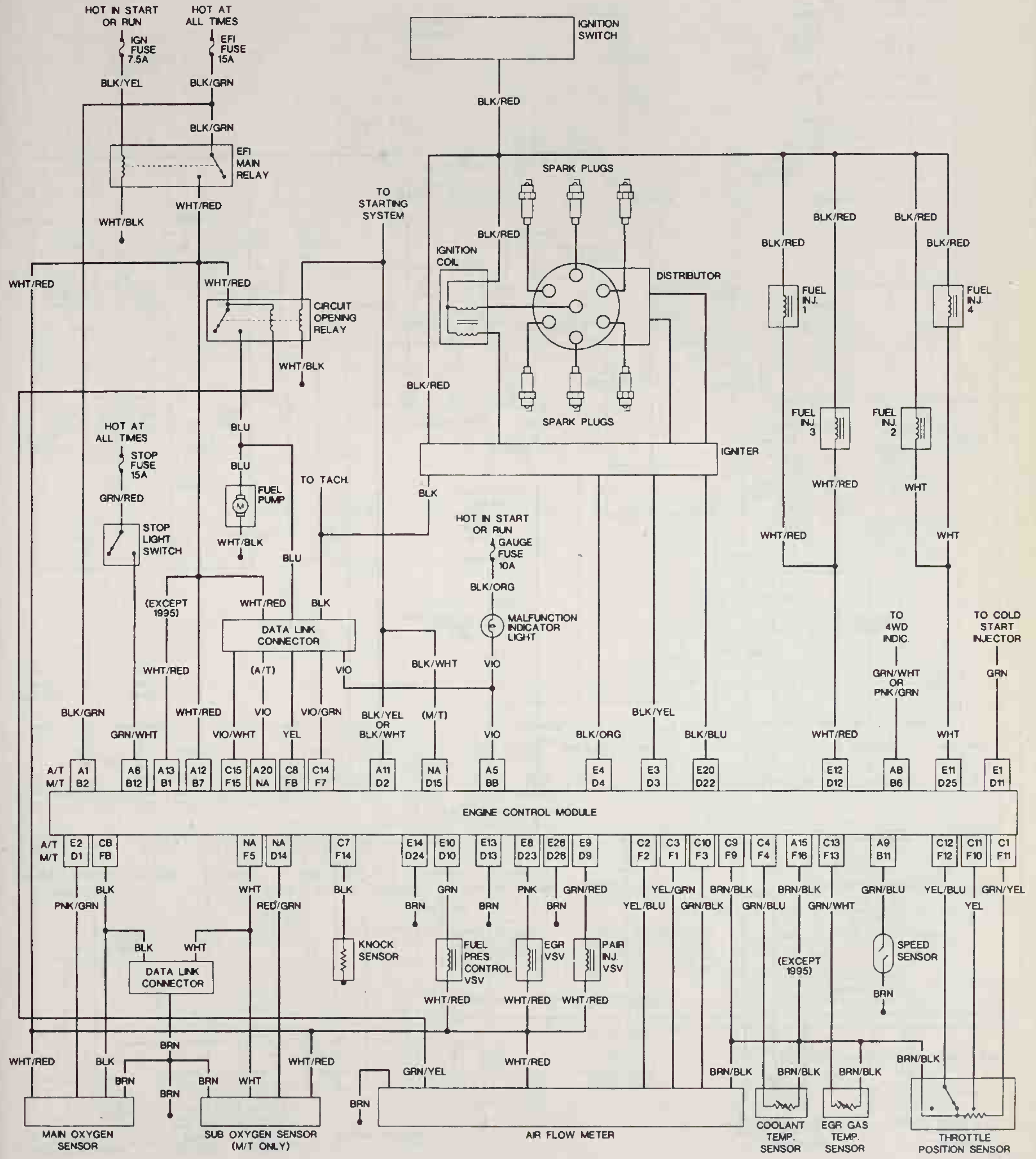

HOT IN START OR RUN
IGN FUSE 7.5A
HOT AT ALL TIMES
EFI FUSE 15A
BLK/YEL
BLK/GRN
BLK/GRN
EFI MAIN RELAY
WHT/RED
WHT/BLK
IGNITION SWITCH
BLK/RED
TO STARTING SYSTEM
SPARK PLUGS
BLK/RED
IGNITION COIL
DISTRIBUTOR
BLK/RED
BLK/RED
BLK/RED
BLK/RED
FUEL INJ. 1
FUEL INJ. 4
WHT/RED
WHT/RED
CIRCUIT OPENING RELAY
WHT/BLK
BLK/RED
SPARK PLUGS
FUEL INJ. 3
FUEL INJ. 2
IGNITER
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
STOP LIGHT SWITCH
BLU
BLU
FUEL PUMP
WHT/BLK
TO TACH.
BLK
BLU
HOT IN START OR RUN
GAUGE FUSE 10A
BLK/ORG
MALFUNCTION INDICATOR LIGHT
WHT/RED
WHT
WHT/RED
WHT
(EXCEPT 1995)
WHT/RED
BLK
DATA LINK CONNECTOR
WHT/RED
(A/T)
VIO
BLK/WHT
VIO
TO 4WD INDIC.
GRN/WHT OR PNK/GRN
TO COLD START INJECTOR
GRN
BLK/GRN
GRN/WHT
WHT/RED
VIO/WHT
VIO
YEL
VIO/GRN
BLK/YEL OR BLK/WHT
(M/T)
VIO
BLK/ORG
BLK/YEL
BLK/BLU
WHT/RED
WHT
A/T
M/T
A1 B2
A6 B12
A13 B1
A12 B7
C15 F15
A20 NA
C8 FB
C14 F7
A11 D2
NA D15
A5 B8
E4 D4
E3 D3
E20 D22
E12 D12
AB B6
E11 D25
E1 D11
ENGINE CONTROL MODULE
A/T
M/T
E2 D1
CB FB
NA F5
NA D14
C7 F14
E14 D24
E10 D10
E13 D13
E8 D23
E26 D26
E9 D9
C2 F2
C3 F1
C10 F3
C9 F9
C4 F4
A15 F16
C13 F13
A9 B11
C12 F12
C11 F10
C1 F11
PNK/GRN
BLK
WHT
RED/GRN
BLK
BRN
GRN
BRN
PNK
BRN
GRN/RED
YEL/BLU
YEL/GRN
GRN/BLK
BRN/BLK
GRN/BLU
BRN/BLK
GRN/WHT
GRN/BLU
YEL/BLU
YEL
GRN/YEL
BLK
WHT
DATA LINK CONNECTOR
KNOCK SENSOR
FUEL PRES CONTROL VSV
EGR VSV
PAIR INJ. VSV
(EXCEPT 1995)
SPEED SENSOR
BRN
WHT/RED
WHT/RED
WHT/RED
BRN
WHT/RED
BLK
BRN
BRN
BRN
WHT
WHT/RED
GRN/YEL
BRN
WHT/RED
BRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
MAIN OXYGEN SENSOR
SUB OXYGEN SENSOR (M/T ONLY)
AIR FLOW METER
COOLANT TEMP. SENSOR
EGR GAS TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w38

Fig. 151 Engine wiring — 4Runner 1993-96 4-cylinder

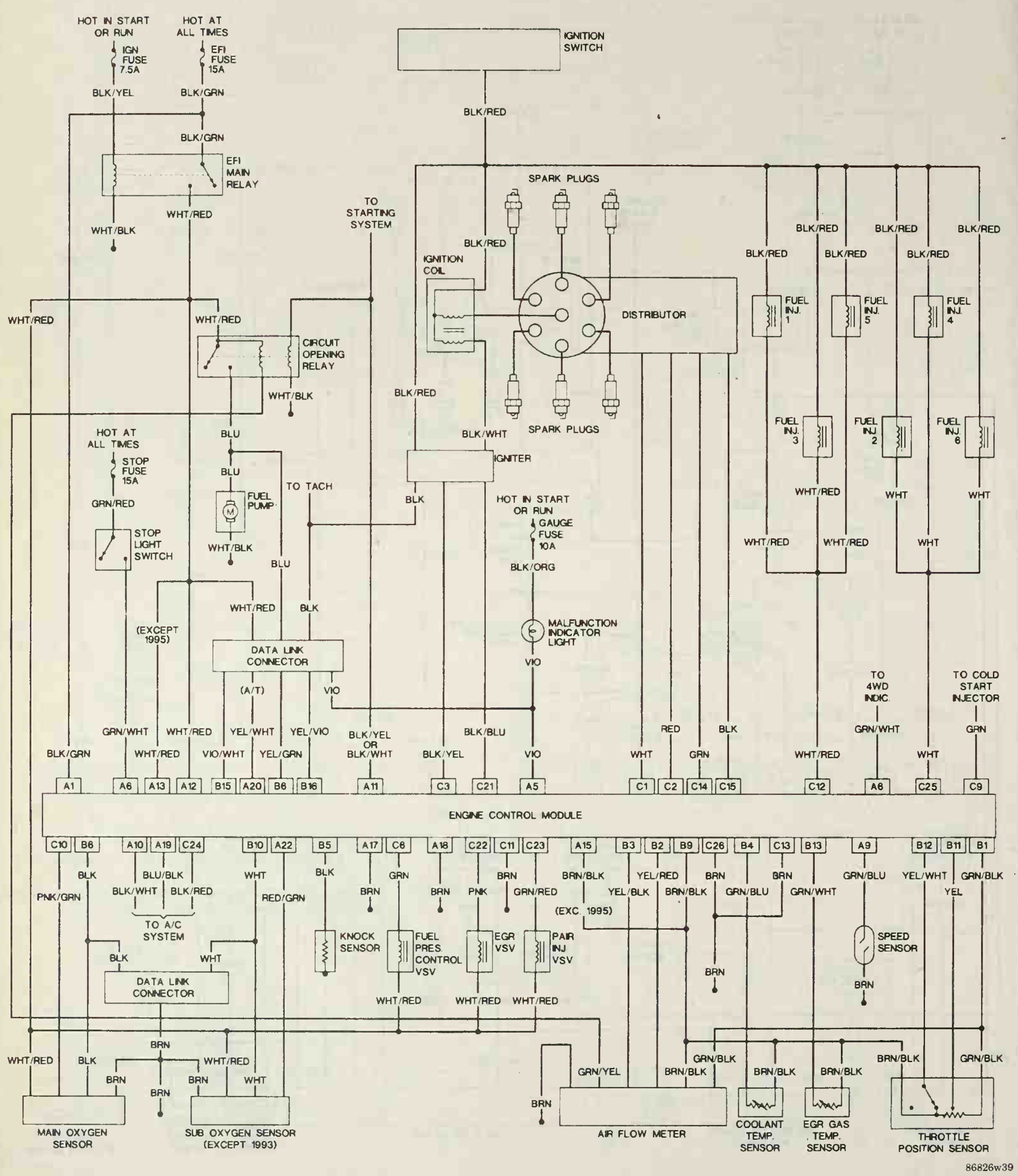

HOT IN START OR RUN
IGN FUSE 7.5A
HOT AT ALL TIMES
EFI FUSE 15A
BLK/YEL
BLK/GRN
BLK/GRN
EFI MAIN RELAY
WHT/RED
WHT/BLK
IGNITION SWITCH
BLK/RED
SPARK PLUGS
TO STARTING SYSTEM
BLK/RED
IGNITION COIL
DISTRIBUTOR
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
BLK/RED
FUEL INJ. 1
FUEL INJ. 5
FUEL INJ. 4
WHT/RED
WHT/RED
CIRCUIT OPENING RELAY
WHT/BLK
BLK/RED
SPARK PLUGS
BLK/WHT
IGNITER
FUEL INJ. 3
FUEL INJ. 2
FUEL INJ. 6
HOT AT ALL TIMES
STOP FUSE 15A
GRN/RED
BLU
BLU
FUEL PUMP
TO TACH
STOP LIGHT SWITCH
WHT/BLK
BLU
BLK
HOT IN START OR RUN
GAUGE FUSE 10A
BLK/ORG
WHT/RED
WHT
WHT
WHT/RED
WHT/RED
WHT
WHT/RED
BLK
(EXCEPT 1995)
DATA LINK CONNECTOR
MALFUNCTION INDICATOR LIGHT
VIO
(A/T)
VIO
TO 4WD INDIC.
TO COLD START INJECTOR
GRN/WHT
WHT/RED
YEL/WHT
YEL/VIO
BLK/YEL OR BLK/WHT
BLK/BLU
RED
BLK
GRN/WHT
GRN
BLK/GRN
WHT/RED
VIO/WHT
YEL/GRN
BLK/YEL
VIO
WHT
GRN
WHT/RED
WHT
A1
A6
A13
A12
B15
A20
B6
B16
A11
C3
C21
A5
C1
C2
C14
C15
C12
A8
C25
C9
ENGINE CONTROL MODULE
C10
B6
A10
A19
C24
B10
A22
B5
A17
C6
A18
C22
C11
C23
A15
B3
B2
B9
C26
B4
C13
B13
A9
B12
B11
B1
BLK
BLU/BLK
WHT
BLK
GRN
BRN
BRN/BLK
YEL/RED
BRN
BRN
GRN/BLU
YEL/WHT
GRN/BLK
PNK/GRN
BLK/WHT
BLK/RED
RED/GRN
BRN
BRN
PNK
GRN/RED
YEL/BLK
BRN/BLK
GRN/BLU
GRN/WHT
YEL
TO A/C SYSTEM
(EXC. 1995)
KNOCK SENSOR
FUEL PRES. CONTROL VSV
EGR VSV
PAIR INJ VSV
SPEED SENSOR
BLK
WHT
BRN
BRN
DATA LINK CONNECTOR
WHT/RED
WHT/RED
WHT/RED
BRN
WHT/RED
BLK
WHT/RED
BRN
BRN
WHT
BRN
GRN/YEL
GRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
BRN/BLK
GRN/BLK
BRN
MAIN OXYGEN SENSOR
SUB OXYGEN SENSOR (EXCEPT 1993)
AIR FLOW METER
COOLANT TEMP. SENSOR
EGR GAS TEMP. SENSOR
THROTTLE POSITION SENSOR
86826w39

Fig. 152 Engine wiring — 4Runner 1993-96 6-cylinder

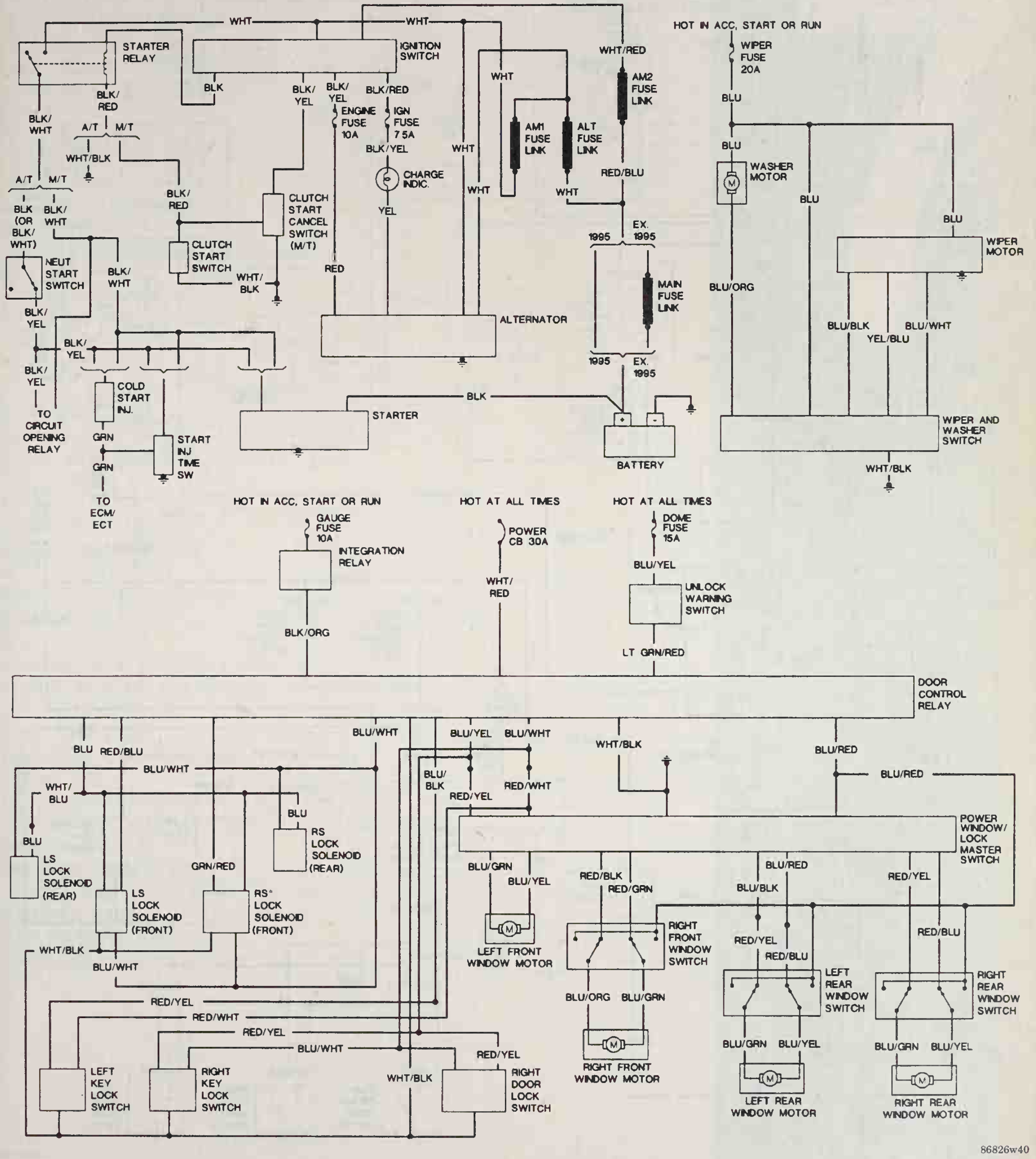

WHT
WHT
STARTER RELAY
IGNITION SWITCH
HOT IN ACC, START OR RUN
WIPER FUSE 20A
WHT/RED
AM2 FUSE LINK
BLK
BLK/YEL
BLK/YEL
BLK/RED
BLK/RED
BLK/WHT
A/T
M/T
ENGINE FUSE 10A
IGN FUSE 7.5A
BLK/YEL
WHT
WHT
AM1 FUSE LINK
ALT FUSE LINK
BLU
BLU
WASHER MOTOR
WHT/BLK
A/T
M/T
CHARGE INDIC.
RED/BLU
BLK (OR BLK/WHT)
BLK/WHT
BLK/RED
CLUTCH START CANCEL SWITCH (M/T)
YEL
WHT
WHT
BLU
BLU
1995
EX. 1995
WIPER MOTOR
NEUT START SWITCH
CLUTCH START SWITCH
BLK/WHT
WHT/BLK
RED
MAIN FUSE LINK
BLU/ORG
BLK/YEL
ALTERNATOR
BLU/BLK
BLU/WHT
YEL/BLU
BLK/YEL
BLK/YEL
1995
EX. 1995
COLD START INJ.
TO CIRCUIT OPENING RELAY
BLK
STARTER
WIPER AND WASHER SWITCH
GRN
GRN
START INJ TIME SW
BATTERY
WHT/BLK
TO ECM/ECT
HOT IN ACC, START OR RUN
GAUGE FUSE 10A
INTEGRATION RELAY
HOT AT ALL TIMES
POWER CB 30A
HOT AT ALL TIMES
DOME FUSE 15A
BLU/YEL
UNLOCK WARNING SWITCH
WHT/RED
BLK/ORG
LT GRN/RED
DOOR CONTROL RELAY
BLU
RED/BLU
BLU/WHT
BLU/YEL
BLU/WHT
WHT/BLK
BLU/RED
BLU/WHT
WHT/BLU
BLU/BLK
RED/YEL
RED/WHT
BLU/RED
BLU
BLU
RS LOCK SOLENOID (REAR)
POWER WINDOW/LOCK MASTER SWITCH
LS LOCK SOLENOID (REAR)
GRN/RED
BLU/GRN
BLU/YEL
RED/BLK
RED/GRN
BLU/RED
BLU/BLK
RED/YEL
LS LOCK SOLENOID (FRONT)
RS* LOCK SOLENOID (FRONT)
LEFT FRONT WINDOW MOTOR
RIGHT FRONT WINDOW SWITCH
RED/YEL
RED/BLU
RED/BLU
WHT/BLK
BLU/WHT
LEFT REAR WINDOW SWITCH
RIGHT REAR WINDOW SWITCH
RED/YEL
BLU/ORG
BLU/GRN
RED/WHT
RED/YEL
BLU/WHT
RED/YEL
RIGHT FRONT WINDOW MOTOR
BLU/GRN
BLU/YEL
BLU/GRN
BLU/YEL
LEFT KEY LOCK SWITCH
RIGHT KEY LOCK SWITCH
WHT/BLK
RIGHT DOOR LOCK SWITCH
LEFT REAR WINDOW MOTOR
RIGHT REAR WINDOW MOTOR
86826w40

Fig. 153 Chassis wiring — 4Runner 1992-96

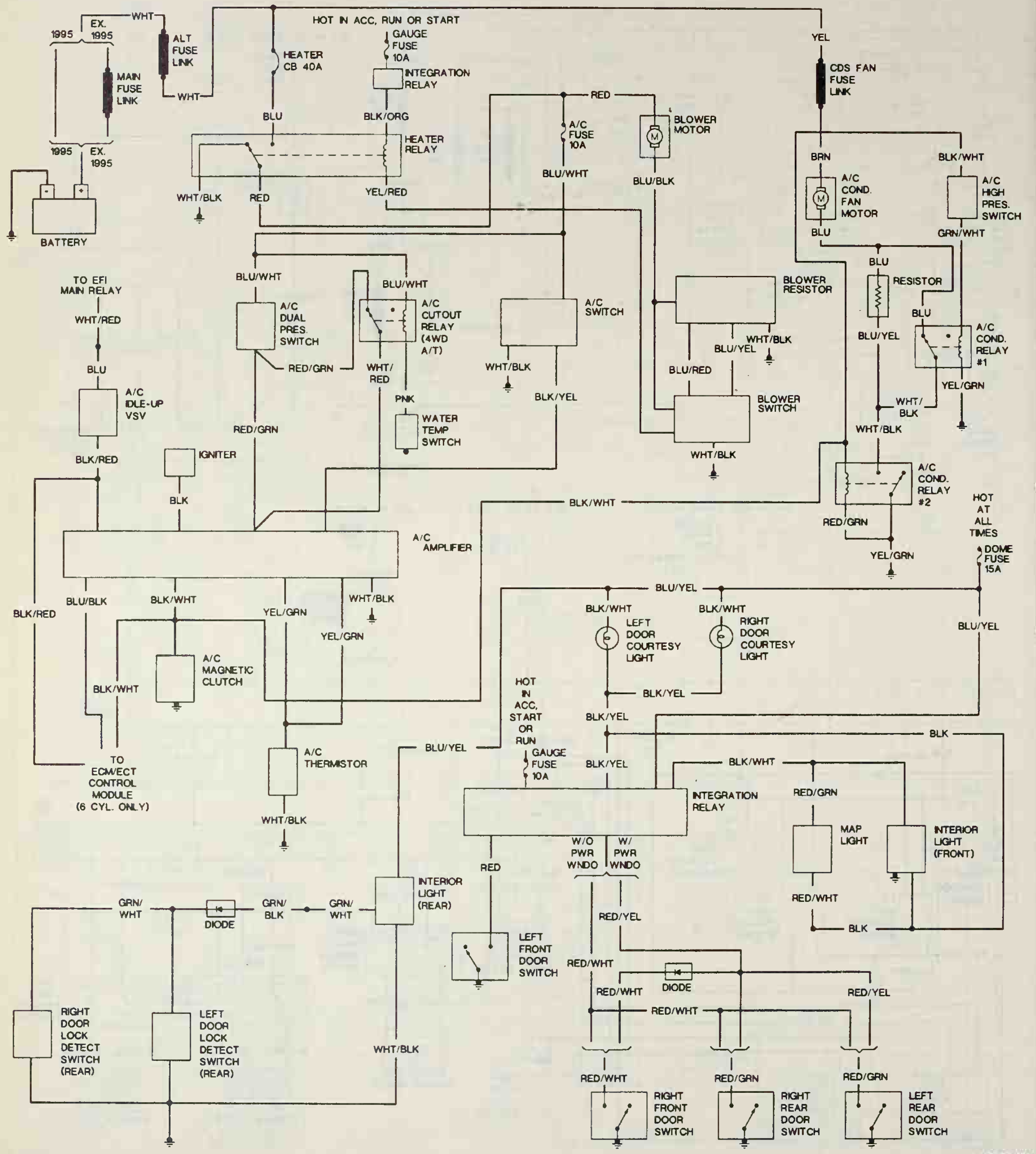

WHT
EX.
1995
1995
ALT
FUSE
LINK
MAIN
FUSE
LINK
WHT
1995
EX.
1995
BATTERY
HOT IN ACC, RUN OR START
GAUGE
FUSE
10A
INTEGRATION
RELAY
HEATER
CB 40A
BLU
BLK/ORG
HEATER
RELAY
WHT/BLK
RED
YEL/RED
RED
A/C
FUSE
10A
BLU/WHT
BLOWER
MOTOR
BLU/BLK
YEL
CDS FAN
FUSE
LINK
BRN
BLK/WHT
A/C
COND.
FAN
MOTOR
A/C
HIGH
PRES.
SWITCH
BLU
GRN/WHT
BLU
RESISTOR
BLOWER
RESISTOR
TO EFI
MAIN RELAY
WHT/RED
BLU
A/C
IDLE-UP
VSV
BLK/RED
BLU/WHT
A/C
DUAL
PRES.
SWITCH
BLU/WHT
A/C
CUTOUT
RELAY
(4WD
A/T)
A/C
SWITCH
RED/GRN
WHT/
RED
WHT/BLK
BLK/YEL
PNK
WATER
TEMP
SWITCH
WHT/BLK
BLU/YEL
BLU/RED
BLU/YEL
BLU
A/C
COND.
RELAY
#1
YEL/GRN
WHT/
BLK
WHT/BLK
BLOWER
SWITCH
WHT/BLK
RED/GRN
IGNITER
BLK
A/C
AMPLIFIER
BLK/WHT
A/C
COND.
RELAY
#2
RED/GRN
YEL/GRN
HOT
AT
ALL
TIMES
DOME
FUSE
15A
BLK/RED
BLU/BLK
BLK/WHT
YEL/GRN
WHT/BLK
YEL/GRN
BLU/YEL
BLK/WHT
BLK/WHT
LEFT
DOOR
COURTESY
LIGHT
RIGHT
DOOR
COURTESY
LIGHT
BLU/YEL
A/C
MAGNETIC
CLUTCH
BLK/WHT
BLK/YEL
HOT
IN
ACC,
START
OR
RUN
BLK/YEL
BLK
BLU/YEL
GAUGE
FUSE
10A
BLK/YEL
BLK/WHT
TO
ECM/ECT
CONTROL
MODULE
(6 CYL. ONLY)
A/C
THERMISTOR
WHT/BLK
INTEGRATION
RELAY
RED/GRN
MAP
LIGHT
INTERIOR
LIGHT
(FRONT)
W/O
PWR
WNDO
W/
PWR
WNDO
RED
RED/WHT
BLK
GRN/
WHT
DIODE
GRN/
BLK
GRN/
WHT
INTERIOR
LIGHT
(REAR)
RED/YEL
LEFT
FRONT
DOOR
SWITCH
RED/WHT
DIODE
RED/WHT
RED/YEL
RED/WHT
RIGHT
DOOR
LOCK
DETECT
SWITCH
(REAR)
LEFT
DOOR
LOCK
DETECT
SWITCH
(REAR)
WHT/BLK
RED/WHT
RED/GRN
RED/GRN
RIGHT
FRONT
DOOR
SWITCH
RIGHT
REAR
DOOR
SWITCH
LEFT
REAR
DOOR
SWITCH

Fig. 154 Chassis wiring — 4Runner 1992-96 continued

7

DRIVE TRAIN

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MANUAL TRANSMISSION

Understanding the Manual Transmission

Because of the way an internal combustion engine breathes, it can produce torque (or twisting force) only within a narrow speed range. Most overhead valve pushrod engines must turn at about 2500 rpm to produce their peak torque. Often by 4500 rpm, they are producing so little torque that continued increases in engine speed produce no power increases.

The torque peak on overhead camshaft engines is, generally, much higher, but much narrower.

The manual transmission and clutch are employed to vary the relationship between engine RPM and the speed of the wheels so that adequate power can be produced under all circumstances. The clutch allows engine torque to be applied to the transmission input shaft gradually, due to mechanical slippage. The vehicle can, consequently, be started smoothly from a full stop.

The transmission changes the ratio between the rotating speeds of the engine and the wheels by the use of gears. 4-speed or 5-speed transmissions are most common. The lower gears allow full engine power to be applied to the rear wheels during acceleration at low speeds.

The clutch driveplate is a thin disc, the center of which is splined to the transmission input shaft. Both sides of the disc are covered with a layer of material which is similar to brake lining and which is capable of allowing slippage without roughness or excessive noise.

The clutch cover is bolted to the engine flywheel and incorporates a diaphragm spring which provides the pressure to engage the clutch. The cover also houses the pressure plate. When the clutch pedal is released, the driven disc is sandwiched between the pressure plate and the smooth surface of the flywheel, thus forcing the disc to turn at the same speed as the engine crankshaft.

The transmission contains a mainshaft which passes all the way through the transmission, from the clutch to the driveshaft. This shaft is separated at one point, so that front and rear portions can turn at different speeds.

Power is transmitted by a countershaft in the lower gears and reverse. The gears of the countershaft mesh with gears on the mainshaft, allowing power to be carried from one to the other. Countershaft gears are often integral with that shaft, while several of the mainshaft gears can either rotate independently of the shaft or be locked to it. Shifting from one gear to the next causes one of the gears to be freed from rotating with the shaft and locks another to it. Gears are locked and unlocked by internal dog clutches which slide between the center of the gear and the shaft. The forward gears usually employ synchronizers; friction members which smoothly bring gear and shaft to the same speed before the toothed dog clutches are engaged.

Identification

The manual transmissions found in Pick-Ups, Tacomas, T100s and 4Runners are denoted by their Toyota model designations: G40, G57, G58, W46, W55, W56, W59, R150 and R150F. The G40 and W46 units are 4-speed transmissions; the others are 5-speeds. The G58, W56, W59 and R150F are used in 4WD applications and are connected to the transfer case. The R150F is coupled to the 3VZ-E engine in 4WD applications. See Section 1 for more information on models.

Adjustments

All models utilize a floor-mounted shifter and an internally-mounted shift linkage. No external adjustments are either necessary or possible.

Back-Up Light Switch

REMOVAL & INSTALLATION

1. Position the shift lever in neutral.
2. Raise the truck and support it on safety stands.
3. Unplug the electrical connector at the switch.
4. Unscrew the back-up light switch from the extension housing.

To install:

5. Screw the new switch into the housing and tighten it to 60 inch lbs. (7 Nm).
6. Connect the wire and lower the truck.

Shift Lever

REMOVAL & INSTALLATION

➧ See Figures 1, 2, 3, 4, 5, 6 and 7

1. Unscrew the shifter knob.
2. Remove the console box if necessary.
3. Remove the boot retainer mounting screws.

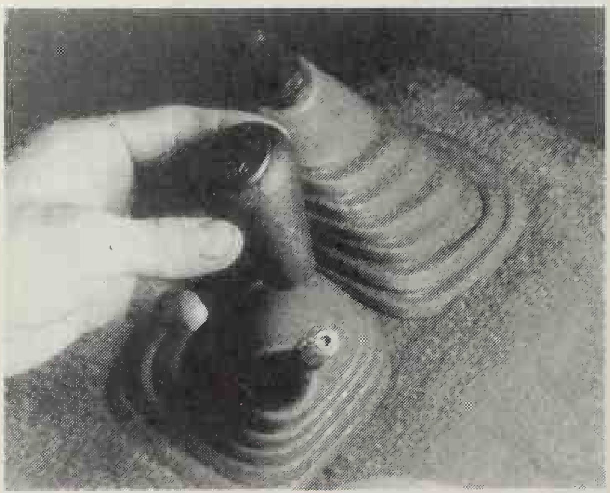
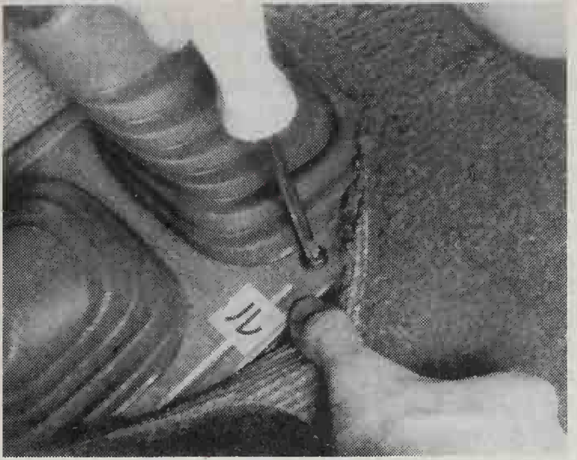


Fig. 1 Unscrew the shifter knob



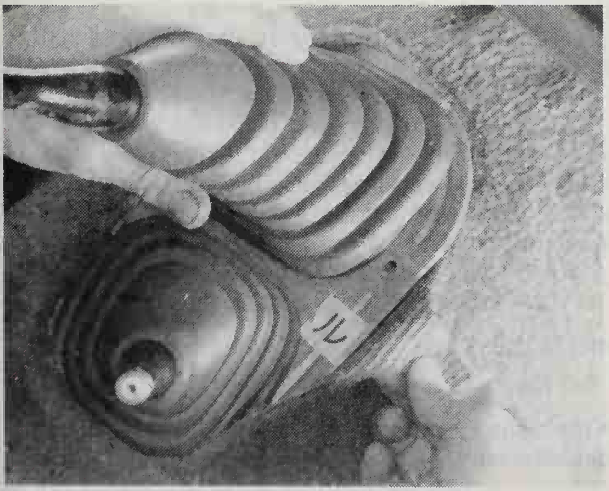
86827p02

Fig. 2 While pulling back the carpeting, loosen and remove the bezel mounting screws

4. Lift the bezel up and over the shifter shaft.
5. Pull the boot up the shaft.
6. Press down on the shift lever cap and rotate it counterclockwise to remove.
7. Put out the shift lever.

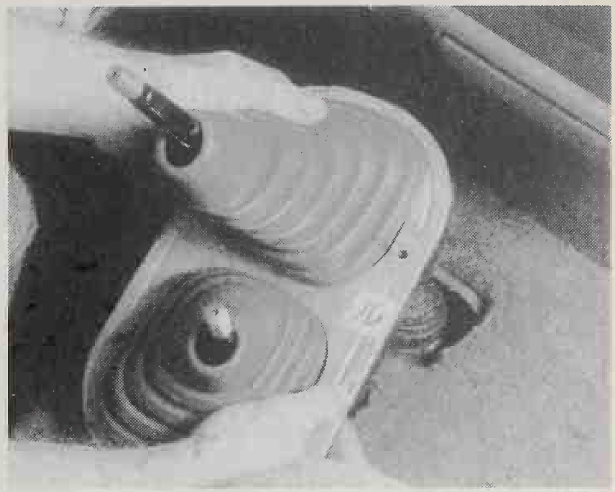
To install:

8. Apply multi-purpose grease to the tip of the shift lever.
9. Insert the lever into the transmission housing.
10. Push down onto the retainer and with a clockwise motion, turn the shaft to lock into position.
11. Lower the boot over the shaft into place.
12. Install the boot retainer retainer over the unit.
13. Tighten the mounting screws. Place the carpeting over the unit.
14. Install the shifter knob.



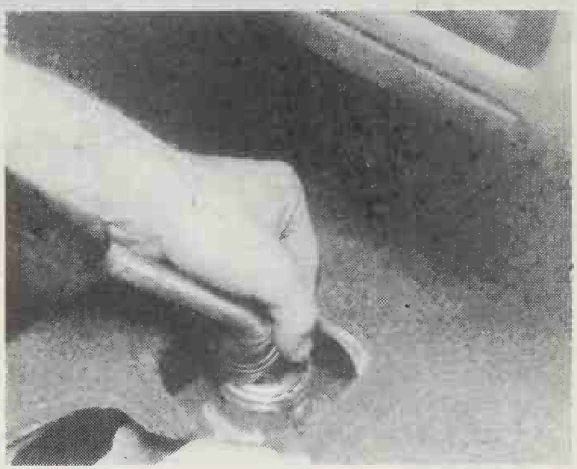
86827p03

Fig. 3 Lift the bezel while pulling the carpet aside



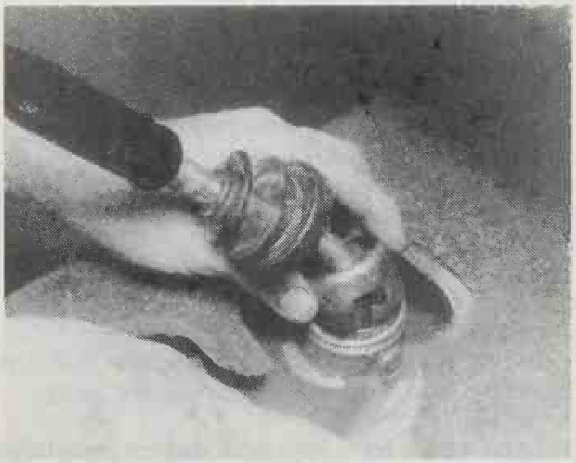
86827p04

Fig. 4 Lift the bezel up and over the shifter shafts



86827p06

Fig. 5 Lift the boot up the shifter shaft to gain access to the lever cap



86827p07

Fig. 6 Press down on the shift lever cap and rotate it counterclockwise

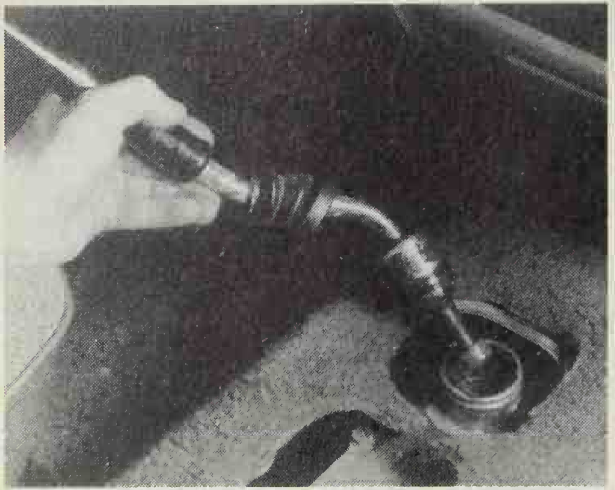


Fig. 7 Pull the lever out of the transmission housing

Transmission Assembly

REMOVAL & INSTALLATION

Pick-Up and 4Runner

2WD MODELS

➧ **See Figures 8, 9, 10 and 11**

1. Disconnect the negative battery cable.
2. Remove the four bolts holding the fan shroud.
3. Remove the shift lever boot retainer. Pull up the boot and cover the shift lever cap with a cloth. Press down on the shift lever cap and turn it counterclockwise to remove it. Remove the shift lever.
4. Raise the truck and support it on safety stands. Double check the supports for secure placement.
5. Drain the fluid from the transmission.
6. Remove the driveshaft and plug the extension housing to prevent oil seepage.
7. Disconnect the speedometer cable.
8. Disconnect the back-up light switch wire.
9. Remove the exhaust pipe clamp from the bracket; disconnect the exhaust pipe at the manifold and remove the clamp bracket from the clutch housing. For vehicles with 3VZ-E engines, remove the pipe bracket from the clutch housing first, then disconnect the pipe at the manifold and from the front of the catalytic converter.
10. Remove the clutch slave cylinder mounting bolts and pipe bracket; position the cylinder out of the way. Do not disconnect the fluid line.
11. Remove the four bolts holding the stabilizer (sway) bar.
12. Remove the four bolts holding the frame auxiliary crossmember.
13. Remove the 4 rear engine mount bolts at the extension housing. Position a block of wood on a floor jack and raise the engine slightly. Remove the 4 rear mount-to-support member bolts and remove the rear engine mount. Remove the rear engine mount from the transmission.
14. Tape a piece of wood about $^{8}/_{10}$ in. (20mm) thick onto the front crossmember and then lower the transmission.
15. Remove the starter. Remove the stiffener plate bolts.
16. Remove the remaining transmission housing bolts.
17. With a floor jack under the transmission case, pull it toward the rear and slowly lower the front end until it can be removed from the truck. On models with the 3VZ-E engine and R150 transmission, turn the transmission about 45° clockwise. Slide it toward the rear, lower the front and then remove it from the truck.

To install:

18. Insert the extension housing between the crossmember and the floor. Slide the transmission forward. Position the transmission case so the input shaft splines align with the clutch disc and push it fully into position. Install the 2 upper mounting bolts.
19. Install the transmission housing and stiffener plate bolts. Install the starter. Tighten the transmission bolts to 53 ft. lbs. (72 Nm) and the stiffener plate bolts to 27 ft. lbs. (37 Nm). Tighten the starter bolt to 29 ft. lbs. (39 Nm).
20. Install the rear engine mount and bracket. Tighten the bolts to 19 ft. lbs. (25 Nm).
21. Raise the engine slightly and position the rear engine mount in the support member and tighten the bolts to 43 ft. lbs. (59 Nm).
22. Lower the transmission until it rests on the rear mount. Install the 4 bolts and tighten them to 22 ft. lbs. (29 Nm).
23. Remove the piece of wood from the front crossmember.
24. Install the exhaust pipe, bracket and clamp. Tighten the exhaust pipe bolts to 46 ft. lbs. (62 Nm). On 22R-E engines, tighten the upper pipe bracket bolts to 14 ft. lbs. (19 Nm) and the lower one to 51 ft. lbs. (69 Nm). On 3VZ-E engines, tighten the pipe bolts at the catalyst to 29 ft. lbs. (39 Nm.)
25. Install the clutch slave cylinder and tube bracket. Tighten the pipe bracket bolts to 53 ft. lbs. (72 Nm). Tighten the slave cylinder bolts to 9 ft. lbs. (12 Nm).
26. Install the stabilizer bar retaining bolts and tighten them to 22 ft. lbs. (29 Nm).
27. Install the frame auxiliary crossmember, tightening the bolts to 70 ft. lbs. (95 Nm).
28. Connect the speedometer cable. Connect the back-up light switch.
29. Remove the extension housing plug and install the driveshaft.
30. Fill the transmission with oil and lower the truck.
31. Apply multi-purpose grease to the shift lever; align the groove of the shift lever cap and the pin part of the case. Cover the shift lever cap with a cloth. Press down on the shaft and turn it clockwise to install. Install the shift lever boot and retainer with the four screws.
32. Install the fan shroud bolts.
33. Connect the battery cable and road test the truck.

4WD MODELS

➧ **See Figure 12**

➡The manual transmission is removed with the transfer case attached.

1. Disconnect the battery cables at the battery, negative cable first.
2. Remove the retaining bolts holding the fan shroud.

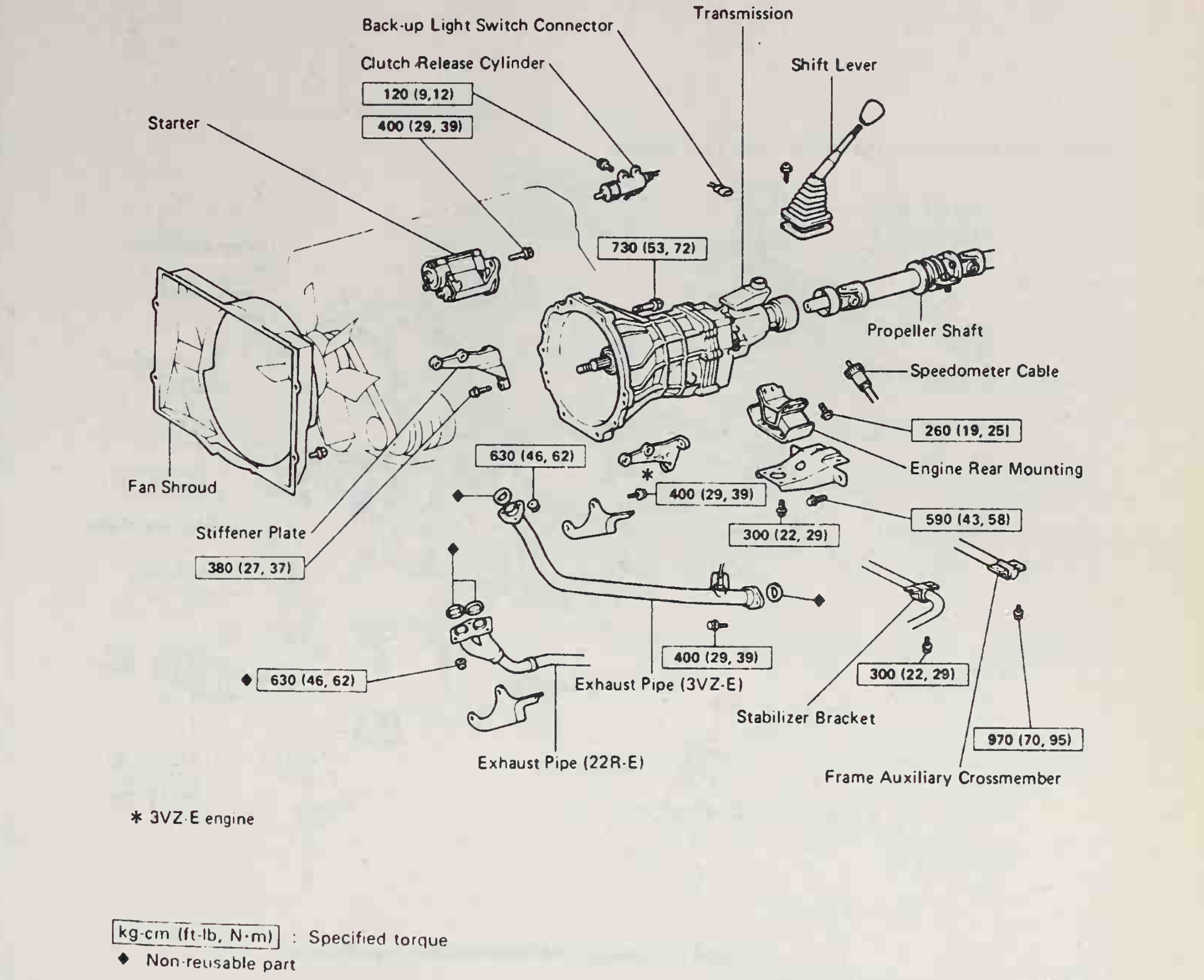

Back-up Light Switch Connector
Transmission
Clutch Release Cylinder
Shift Lever
120 (9,12)
400 (29, 39)
Starter
730 (53, 72)
Propeller Shaft
Speedometer Cable
260 (19, 25)
Engine Rear Mounting
630 (46, 62)
400 (29, 39)
590 (43, 58)
300 (22, 29)
Fan Shroud
Stiffener Plate
380 (27, 37)
400 (29, 39)
630 (46, 62)
300 (22, 29)
Exhaust Pipe (3VZ-E)
Stabilizer Bracket
970 (70, 95)
Exhaust Pipe (22R-E)
Frame Auxiliary Crossmember
* 3VZ-E engine
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86827g18

Fig. 8 Exploded view of the manual transmission and related components — 2WD Pick-Up

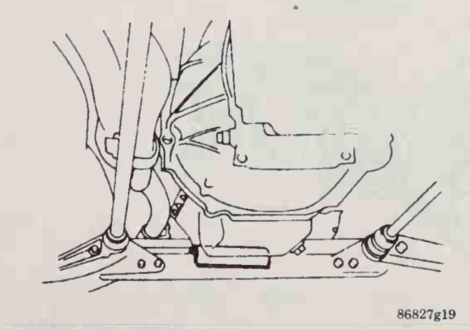


Fig. 9 A piece of wood must be taped to the front crossmember

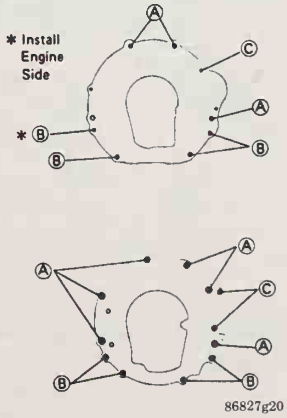

* Install Engine Side
Ⓐ
Ⓒ
Ⓐ
*Ⓑ
Ⓑ
Ⓑ
Ⓐ
Ⓐ
Ⓒ
Ⓐ
Ⓑ
Ⓑ
86827g20

Fig. 10 Engine series 22R-E (top) and 3VZ-FE (bottom) bolt hole locations on 2WD manual transmissions: "A" is for transmission mounting, "B" is for the stiffener, and "C" is for the starter

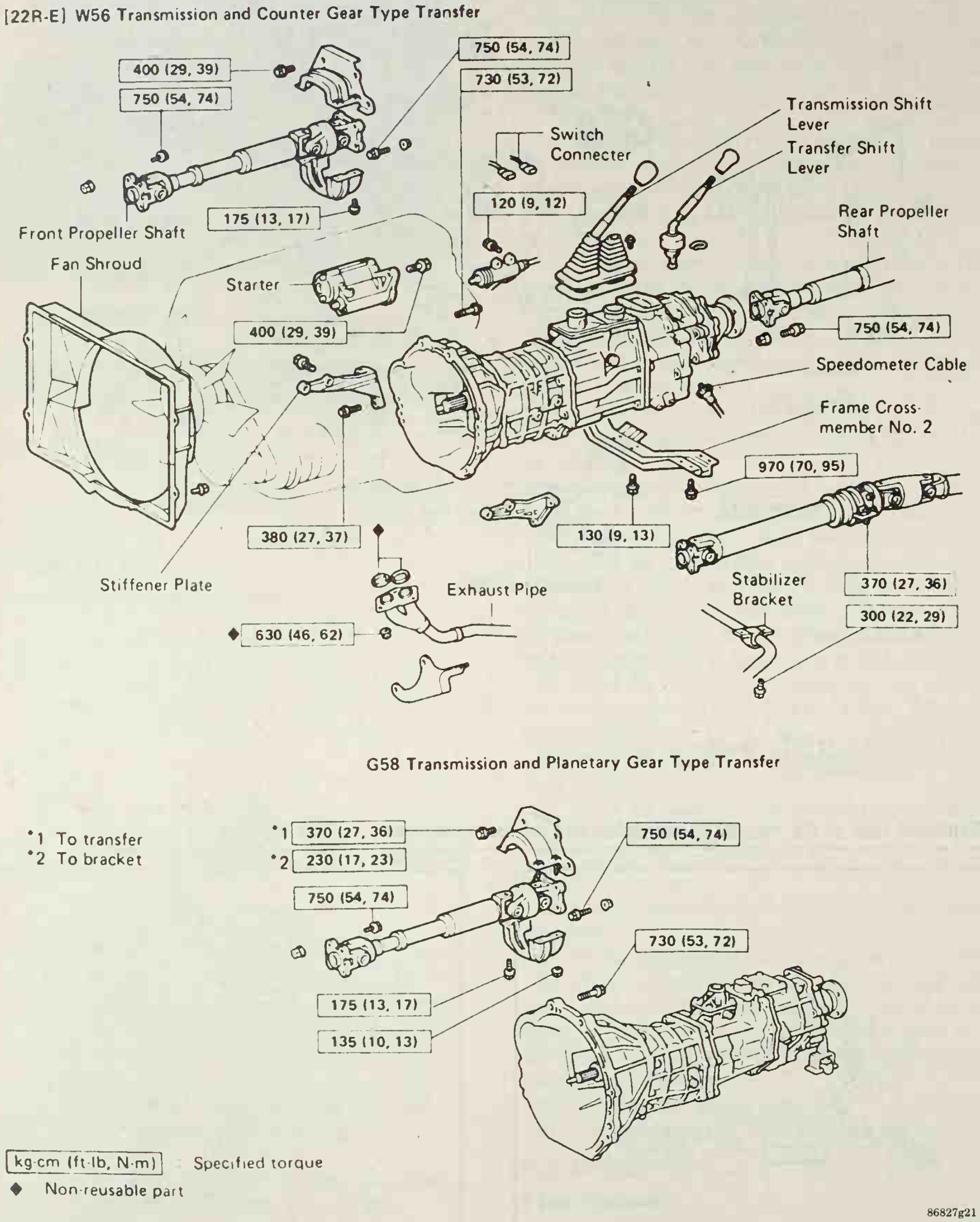

[22R-E] W56 Transmission and Counter Gear Type Transfer
400 (29, 39)
750 (54, 74)
750 (54, 74)
730 (53, 72)
Transmission Shift Lever
Transfer Shift Lever
Switch Connecter
175 (13, 17)
120 (9, 12)
Rear Propeller Shaft
Front Propeller Shaft
Fan Shroud
Starter
400 (29, 39)
750 (54, 74)
Speedometer Cable
Frame Cross-member No. 2
970 (70, 95)
380 (27, 37)
130 (9, 13)
Stiffener Plate
Exhaust Pipe
Stabilizer Bracket
370 (27, 36)
300 (22, 29)
◆ 630 (46, 62)
G58 Transmission and Planetary Gear Type Transfer
*1 To transfer
*2 To bracket
*1 370 (27, 36)
*2 230 (17, 23)
750 (54, 74)
750 (54, 74)
730 (53, 72)
175 (13, 17)
135 (10, 13)
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86827g21

Fig. 11 Exploded view of the manual transmission and related components — W56 with 22R-E engine

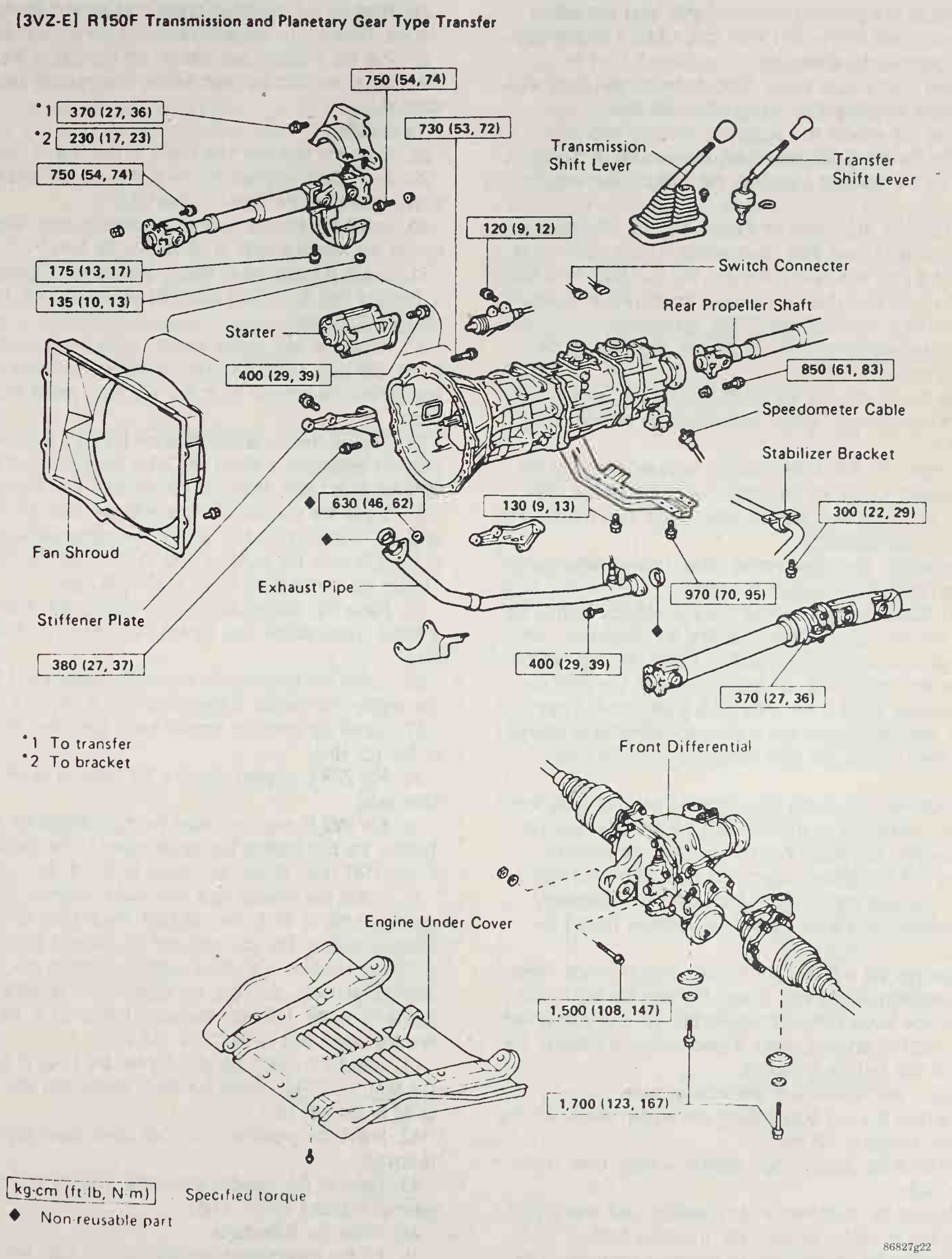

[3VZ-E] R150F Transmission and Planetary Gear Type Transfer
750 (54, 74)
*1 370 (27, 36)
*2 230 (17, 23)
730 (53, 72)
750 (54, 74)
Transmission Shift Lever
Transfer Shift Lever
120 (9, 12)
175 (13, 17)
135 (10, 13)
Switch Connecter
Rear Propeller Shaft
Starter
400 (29, 39)
850 (61, 83)
Speedometer Cable
Stabilizer Bracket
630 (46, 62)
130 (9, 13)
300 (22, 29)
Fan Shroud
Exhaust Pipe
970 (70, 95)
Stiffener Plate
380 (27, 37)
400 (29, 39)
370 (27, 36)
*1 To transfer
*2 To bracket
Front Differential
Engine Under Cover
1,500 (108, 147)
1,700 (123, 167)
kg-cm (ft-lb, N-m) Specified torque
◆ Non-reusable part
86827g22

Fig. 12 Exploded view of the manual transmission and related components — R150F with 3VZ-FE engine

3. On 3VZ-E engines, loosen the clamp on the heater hose at the firewall and move the clamp up the heater hose out of the way.

4. Remove the four screws holding the shift lever boot retainer. Pull up the boot and cover the shift lever cap with a cloth. Press down on the shift lever cap, rotate it counterclockwise and remove the shift lever.

5. Using needle nose pliers, remove the transfer case shift lever retainer snapring, then remove the shift lever.

6. Raise the vehicle and support is securely with jackstands. Double check the placement and security of the stand.

7. Drain the lubricant from both the transmission and the transfer case.

8. Matchmark the driveshaft flanges and the differential pinion flanges to indicate their relationships. These marks must be aligned during installation. Remove the four bolts from each end of the front driveshaft and remove the driveshaft assembly. On vehicles with G58 and R150F transmissions, it is necessary to remove the propeller shaft dust cover before the shaft is removed.

9. Matchmark the rear driveshaft and the slip yoke to indicate their relationships. These marks must be aligned during installation.

10. Remove the four bolts from the rearward flange of the rear driveshaft. Lower the driveshaft out of the vehicle. Remove the four bolts from the slip yoke flange then remove the flange and yoke assembly.

11. Disconnect the speedometer cable, reverse lamp switch connector and transfer switch connector.

12. On 3VZ-E engines, remove the exhaust pipe clamp, the exhaust bracket from the clutch housing and disconnect the exhaust pipe at the exhaust manifold. Disconnect the exhaust pipe from the front of the catalyst and remove the pipe. On 22R-E engines, remove the bolts holding the exhaust pipe clamp to the transmission and disconnect the exhaust pipe at the manifold. Support the pipe out of the way with wire or rope.

13. Disconnect the clutch slave cylinder retaining bolts and move the cylinder out of the way with the line attached. On 22R-E engines, the piping bracket must also be removed.

14. On 3VZ-E engines, support the front differential with a floor jack; remove the 3 bolts holding the front differential.

15. Remove the 4 bolts holding the stabilizer (sway) bar brackets.

16. Remove the 4 bolts from the rear engine mount. Raise the transmission slightly with a jack. Remove the eight bolts from the side frame rails and remove the No. 2 crossmember.

17. For 22R-E engines, place a piece of wood between the engine oil pan and the front axle.

18. Lower the transmission and transfer case.

19. Remove the two bolts holding the starter; place or hang the starter alongside the motor.

20. Remove the exhaust pipe bracket and the bolts in the stiffener plate.

21. Support the transmission and transfer case with a jack. Remove the remaining transmission mounting bolts.

22. Remove the transmission by moving it rearward; once clear, lower the front of the transmission and remove the unit from the vehicle.

23. Remove the breather hose between the transfer case and the transmission case.

24. Remove the rear engine mount from the transmission case.

25. If equipped with a dynamic damper at the rear of the case, remove it.

26. Remove the driveshaft upper dust cover from the bracket. Remove the mounting bolts for the transfer adapter.

27. Pull the transfer case straight off the end of the transmission. Do not damage the transfer case rear oil seal during removal.

To install:

28. Move the two shift fork shafts to the High-4 position.

29. Apply multi-purpose grease to the adaptor oil seal. Install a new gasket on the transfer case adapter.

30. Install the transfer case to the transmission. Install and tighten the retaining bolts to 28 ft. lbs. (38 Nm).

31. Install the dust cover bolt to the bracket. Tighten to 17 ft. lbs. (23 Nm) for R150F and G58 units and 29 ft. lbs. (39 Nm) for W56 units.

32. Install the rear engine mount, tightening the bolts to 19 ft. lbs. (25 Nm). Install the dynamic damper if it was removed and tighten the bolts to 27 ft. lbs. (37 Nm). Install the breather hose.

33. Support the transmission assembly on a jack. Move the unit into installation position and align the input shaft spline with the clutch disc. Push the transmission fully into position.

34. Install the transmission and stiffener bolts. On 3VZ-E engines, install the starter. Tighten the transmission bolts to 53 ft. lbs. (72 Nm), the stiffener bolts to 27 ft. lbs. (37 Nm). Tighten the starter bolts to 29 ft. lbs. (39 Nm).

35. Raise the transmission slightly with a jack. Install the No. 2 frame crossmember and tighten the bolts to 70 ft. lbs. (95 Nm).

36. Lower the transmission assembly. Install the 4 bolts to the engine rear mount; tighten them to 9 ft. lbs. (13 Nm).

37. Install the stabilizer bracket bolts, tightening them to 22 ft. lbs. (29 Nm).

38. For 22R-E engines, remove the piece of wood from the front axle.

39. For 3VZ-E engines, install the front differential bolts. Tighten the bolt holding the carrier cover to the frame to 108 ft. lbs. (147 Nm); tighten the others to 123 ft. lbs. (167 Nm).

40. Install the exhaust pipe. For 3VZ-E engines, tighten the manifold bolts to 46 ft. lbs. (62 Nm), the bracket to the clutch housing to 29 ft. lbs. (39 Nm) and the exhaust pipe clamp to 14 ft. lbs. (19 Nm). On 22R-E engines , tighten the manifold bolts to 46 ft. lbs. (62 Nm), the upper clutch housing clamp bolt to 14 ft. lbs. (19 Nm), the lower bolt to 51 ft. lbs. (69 Nm) and the clamp bolt to 14 ft. lbs. (19 Nm).

41. Install the clutch cylinder; tighten the bolts to 9 ft. lbs. (12 Nm); on 22R-E, install the lower starter bolt and tighten it to 29 ft. lbs. (39 Nm).

42. Install the propeller shaft dust cover assembly if one was removed.

43. Connect the speedometer cable, reverse light switch and transfer indicator switch wiring.

44. Install the driveshafts.

45. Fill the transmission and the transfer case with the proper amount of oil.

46. Lower the vehicle to the ground.

47. Install the transfer shift lever and secure it with the snapring.

48. Install the transmission shift lever. Lightly grease the lever; align the groove of the shift lever cap and the pin of the case cover. Cover the shift lever cap with a cloth; press down on the cap and rotate the lever clockwise to install the lever.
49. On 3VZ-E engines, move the clamp on the heater hose to the correct location and secure the clamp.
50. Install the retaining bolts in the fan shroud.
51. Connect the negative battery terminal.
52. Test drive the vehicle, operating it in all transmission and drive modes. Check for correct operation, ease of shifting, etc.

T100 and Tacoma

RF150

See Figure 13

On vehicles with the RF150 and RF150F transmissions, the engine and transmission are removed as an assembly. Refer to Section 3 for removal procedures. Separate the transmission from the engine as follows:

1. Unbolt the rear end plate.
2. Remove the starter.
3. Loosen and remove the transmission mounting bolts from the engine. Pull out the transmission toward the rear.
4. Unbolt the rear engine mounting.

To install:

5. Attach the rear engine mounting bolts, tighten to 18 ft. lbs. (25 Nm).
6. Install the transmission, tighten the engine mounting bolts to 53 ft. lbs. (73 Nm).
7. Install the starter to the engine, tighten to 29 ft. lbs. (39 Nm).
8. Install the rear end and stiffener plates with the mounting bolts, tighten to 27 ft. lbs. (37 Nm).
9. Install the engine and transmission into the vehicle; refer to Section 3.

RF150F

See Figure 14

1. Remove the transmission shift lever.
2. Raise the vehicle, then drain the transmission fluid.
3. Remove the front propeller shaft.
4. Remove the rear propeller shaft.

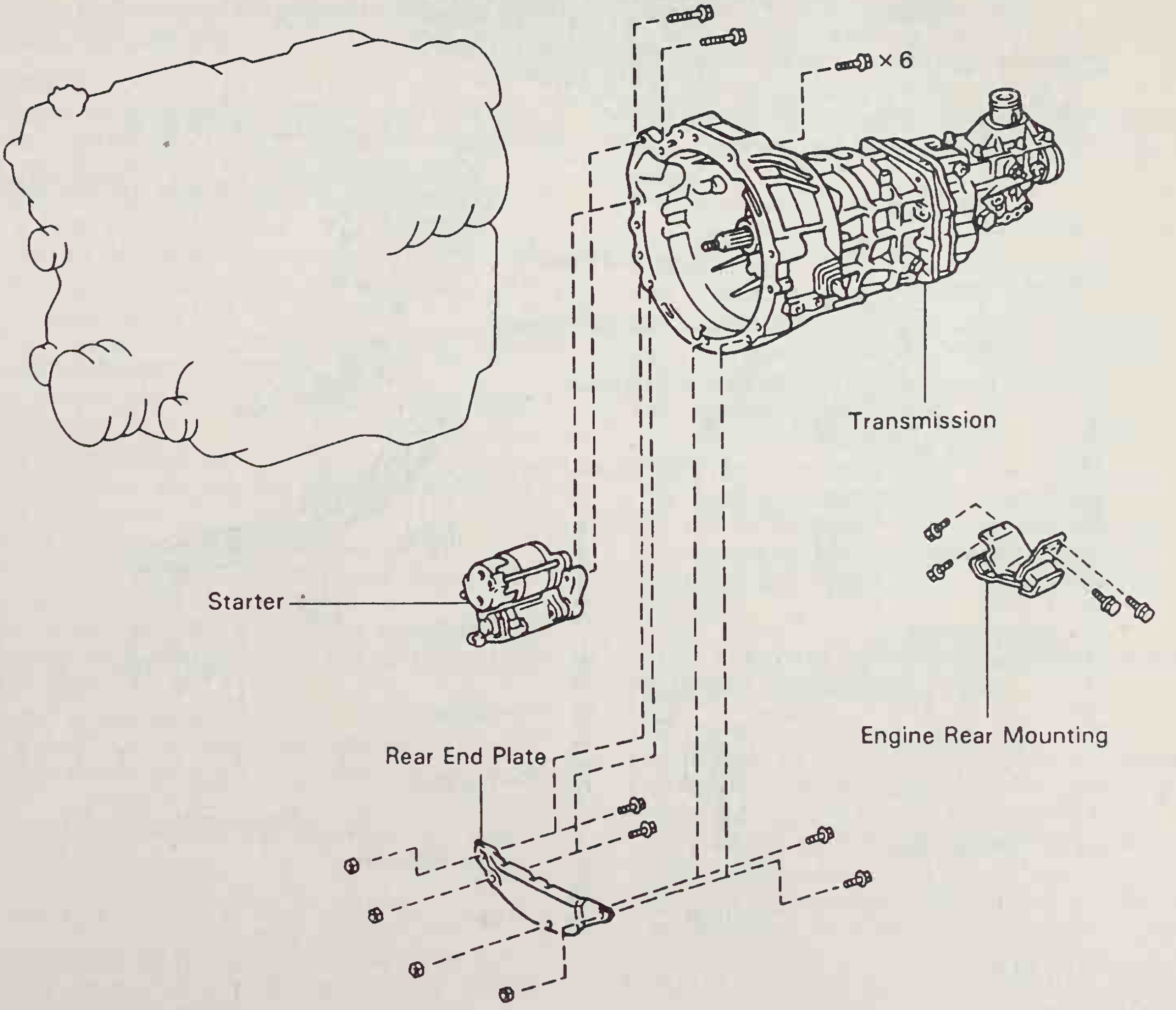


Fig. 13 RF150 manual transmission — T100

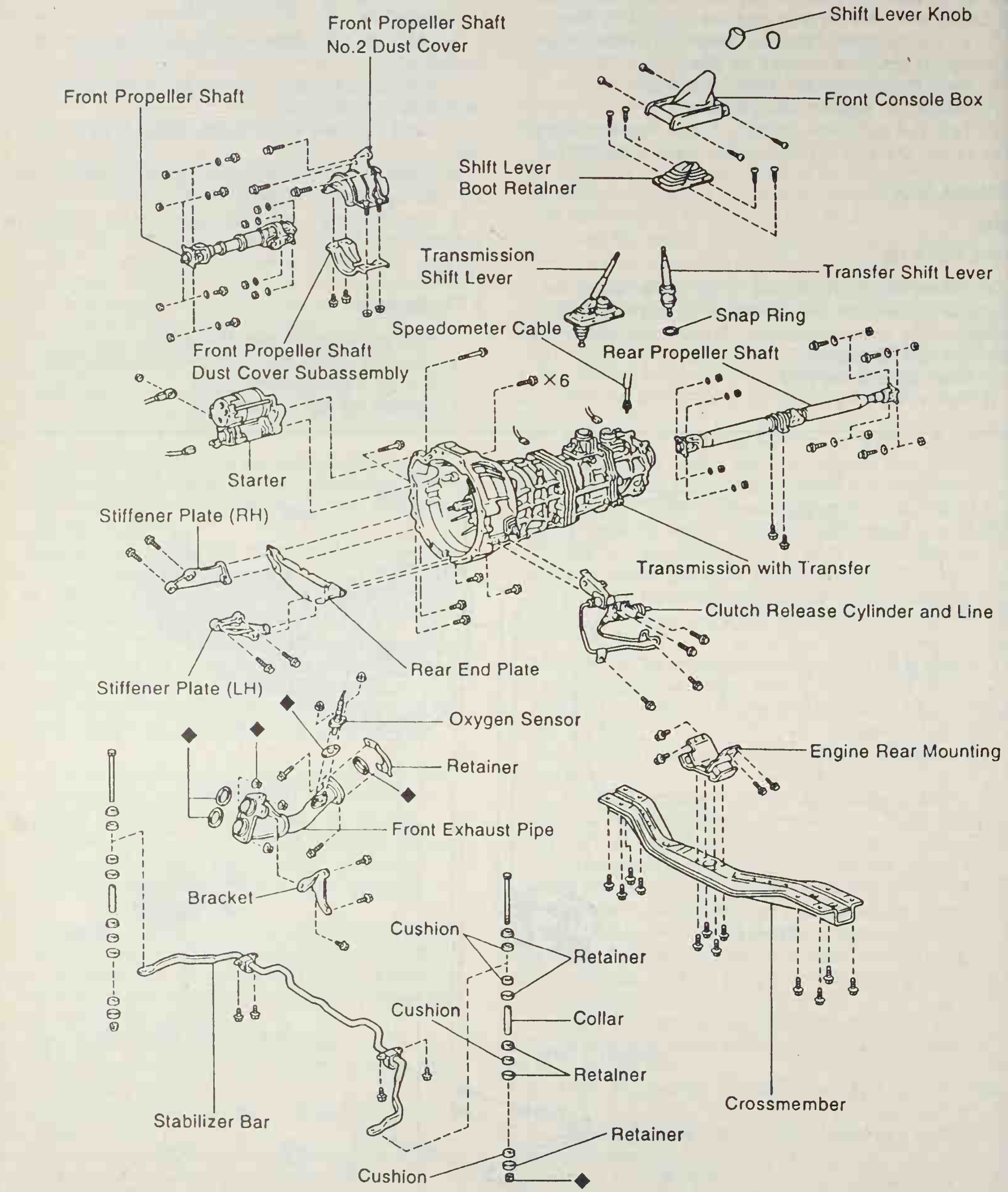

Front Propeller Shaft No.2 Dust Cover
Shift Lever Knob
Front Propeller Shaft
Front Console Box
Shift Lever Boot Retainer
Transmission Shift Lever
Transfer Shift Lever
Snap Ring
Speedometer Cable
Front Propeller Shaft Dust Cover Subassembly
Rear Propeller Shaft
×6
Starter
Stiffener Plate (RH)
Transmission with Transfer
Clutch Release Cylinder and Line
Rear End Plate
Stiffener Plate (LH)
Oxygen Sensor
Engine Rear Mounting
Retainer
Front Exhaust Pipe
Bracket
Cushion
Retainer
Cushion
Collar
Retainer
Crossmember
Stabilizer Bar
Retainer
Cushion
◆ Non-reusable part
86827g10

Fig. 14 RF150F manual transmission — T100

5. Disconnect the speedometer cable.
6. Unplug the back-up light switch and the 4WD position switch connector.
7. Remove the 2 bolts, then slave cylinder.
8. Remove the connection and wire from the starter. Remove the bolt for the starter lower side with the clutch line bracket.
9. Remove the front exhaust pipe, separate the oxygen sensor from the pipe.
10. Remove the starter.
11. Remove the bolts and nuts retaining the rear end and right and left stiffener plates.
12. Unbolt the stabilizer bar.
13. Jack up the transmission slightly.
14. Remove the bolts from the engine rear mounting, then remove the bolts and nuts for the crossmember.
15. Remove the 6 transmission mounting bolts from the engine. Disconnect the wire clamps from the transmission. Pull the transmission down and towards the rear.
16. Remove the 4 bolts and the engine rear mounting.
17. Remove the transfer adapter rear mounting bolts. Pull the transfer case straight up, then remove it from the transmission.

➡Take care not to damage the adapter rear oil seal with the transfer input gear slide.

To install:

18. Support the transmission and transfer case assembly.
19. Attach the transfer case to the transmission. Tighten the adapter rear mounting bolts 27 ft. lbs. (37 Nm).
20. Place the rear engine mounting bolts in place and tighten to 18 ft. lbs. (25 Nm).
21. Place the transmission/transfer case into position. Attach the wire clamps to the transmission, then tighten the 6 rear engine mounting bolts to 53 ft. lbs. (72 Nm).
22. Install the nuts and bolts for the crossmember, tighten to 70 ft. lbs. (95 Nm).
23. Install the 4 bolts to the rear engine mounting, tighten to 9 ft. lbs. (13 Nm).
24. Install the stabilizer bar.
25. Attach the rear end plate and stiffener plates. Tighten to 27 ft. lbs. (37 Nm).
26. Install the starter, tighten to 29 ft. lbs. (39 Nm).
27. Install the front exhaust pipe with a new gasket, install the oxygen sensor.
28. Attach the slave cylinder, tighten 9 ft. lbs. (12 Nm).
29. Engage the back-up light switch and the 4WD position switch connection.
30. Install the speedometer cable.
31. Install the rear and front propeller shafts.
32. Lower the vehicle, fill the transmission with clean fresh fluid.
33. Install the transfer case and transmission shift levers.

W59 — 2-WHEEL DRIVE

➧ See Figure 15

On vehicles with the W59 transmission, the engine and transmission are removed as an assembly. Refer to Section 3 for removal procedures. Separate the transmission from the engine as follows:

1. Remove the transmission with the engine.
2. Unbolt the rear end and stiffener plates.
3. Remove the starter.
4. Remove the transmission mounting bolts from the engine. Pull out the transmission toward the rear.
5. Remove the rear engine mount.

To install:

6. Attach the rear engine mount bolts, tighten to 48 ft. lbs. (65 Nm).
7. Install the transmission. Tighten the mounting bolts to 53 ft. lbs. (73 Nm).
8. Install the starter to the engine, tighten to 29 ft. lbs. (39 Nm).
9. Install the rear end and stiffener plates with the mounting bolts, tighten to 27 ft. lbs. (37 Nm).
10. Install the engine and transmission into the vehicle; refer to Section 3.

W59 — 4-WHEEL DRIVE

➧ See Figures 16, 17, 18, 19, 20, 21 and 22

1. Remove the transmission shift lever.
2. Raise the vehicle, then drain the transmission fluid.
3. Remove the front propeller shaft.
4. Remove the rear propeller shaft.
5. Disconnect the speedometer cable.
6. Disconnect the back-up light switch and the 4WD position switch connector.
7. Remove the slave cylinder.
8. Remove the connection and wire from the starter. Remove the bolt for the starter lower side with the clutch line bracket.
9. Remove the front exhaust pipe.
10. Remove the bolts and nuts retaining the rear end and stiffener plates.
11. If applicable, remove the stabilizer bar.
12. Support the transmission rear side. Remove the bolts from the engine rear mounting. Disconnect the O-ring, then remove the bolts and nuts for the crossmember.
13. Remove the rear mounting.
14. Jack up the transmission slightly, then remove the starter.
15. Remove the 4 transmission mounting bolts from the engine. Pull the transmission down and towards the rear.
16. Remove the transfer adapter rear mounting bolts. Pull the transfer case straight up, then remove it from the transmission.

➡Take care not to damage the adapter rear oil seal with the transfer case input gear slide.

To install:

17. Support the transmission and transfer case assembly.
18. Attach the transfer case to the transmission. Tighten the adapter rear mounting bolts 17 ft. lbs. (24 Nm).
19. Place the assembly into position, then tighten the 4 rear engine mounting bolts to 53 ft. lbs. (72 Nm).
20. Install the starter and tighten to 29 ft. lbs. (39 Nm).
21. Attach the rear mounting bolts for the engine, tighten to 48 ft. lbs. (65 Nm).
22. Install a new O-ring, then install the nuts and bolts for the crossmember. Tighten to 48 ft. lbs. (65 Nm).
23. Install the rear engine mounting bolts, tighten to 14 ft. lbs. (19 Nm).

24. Attach the rear end plate, tighten to 27 ft. lbs. (37 Nm).
25. Install the front exhaust pipe with a new gasket.
26. Install the starter set bolt, tighten to 29 ft. lbs. (39 Nm).
27. Attach the slave cylinder, tighten 9 ft. lbs. (12 Nm).
28. Engage the back-up light switch and the 4WD position switch connection.
29. Install the speedometer cable.
30. Install the rear and front propeller shafts.
31. Lower the vehicle, fill the transmission with clean fresh fluid.
32. Install the transfer case and transmission shift levers.

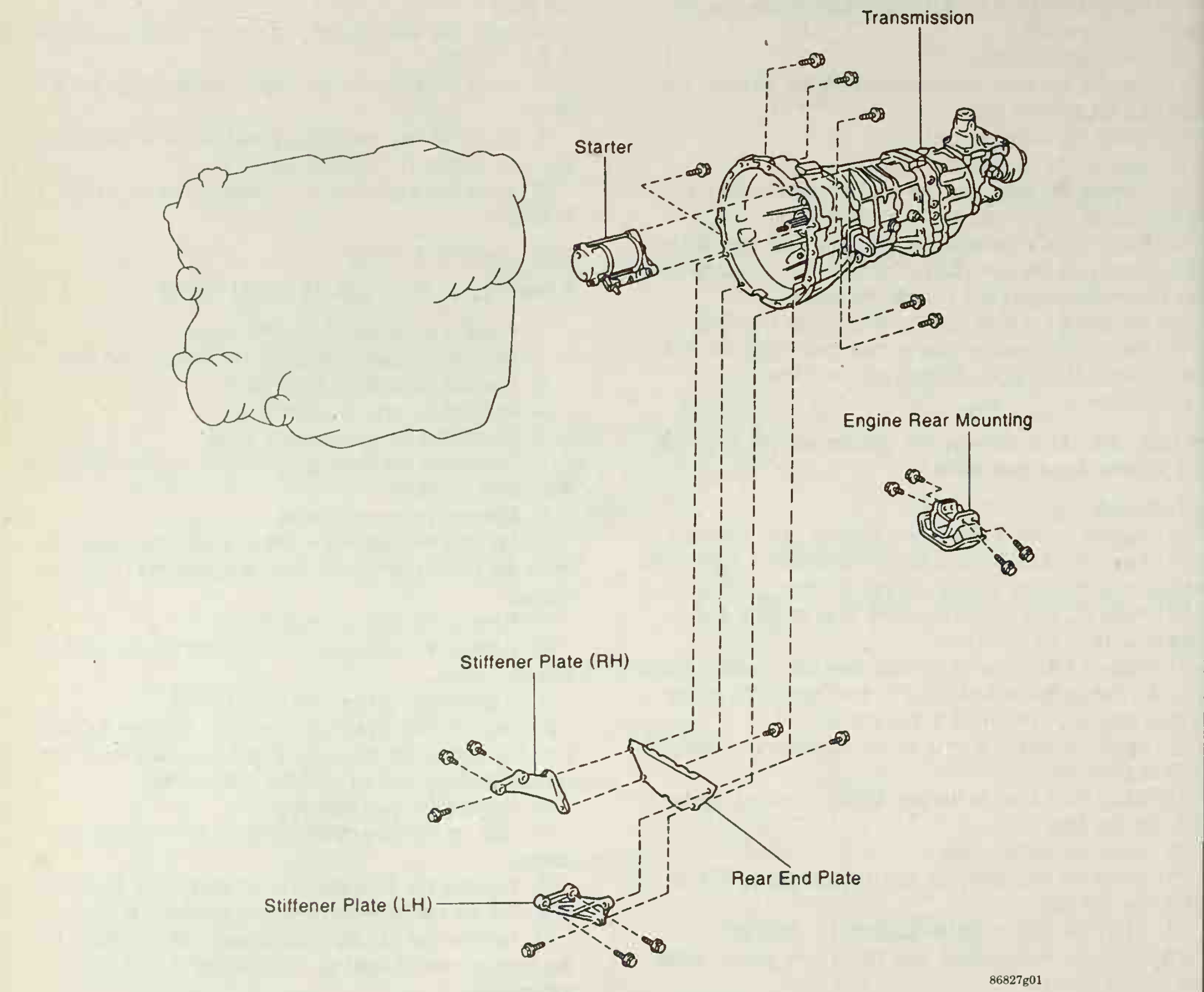

Transmission
Starter
Engine Rear Mounting
Stiffener Plate (RH)
Rear End Plate
Stiffener Plate (LH)
86827g01

Fig. 15 W59 manual transmission — 2WD Tacoma with 2RZ-FE engine

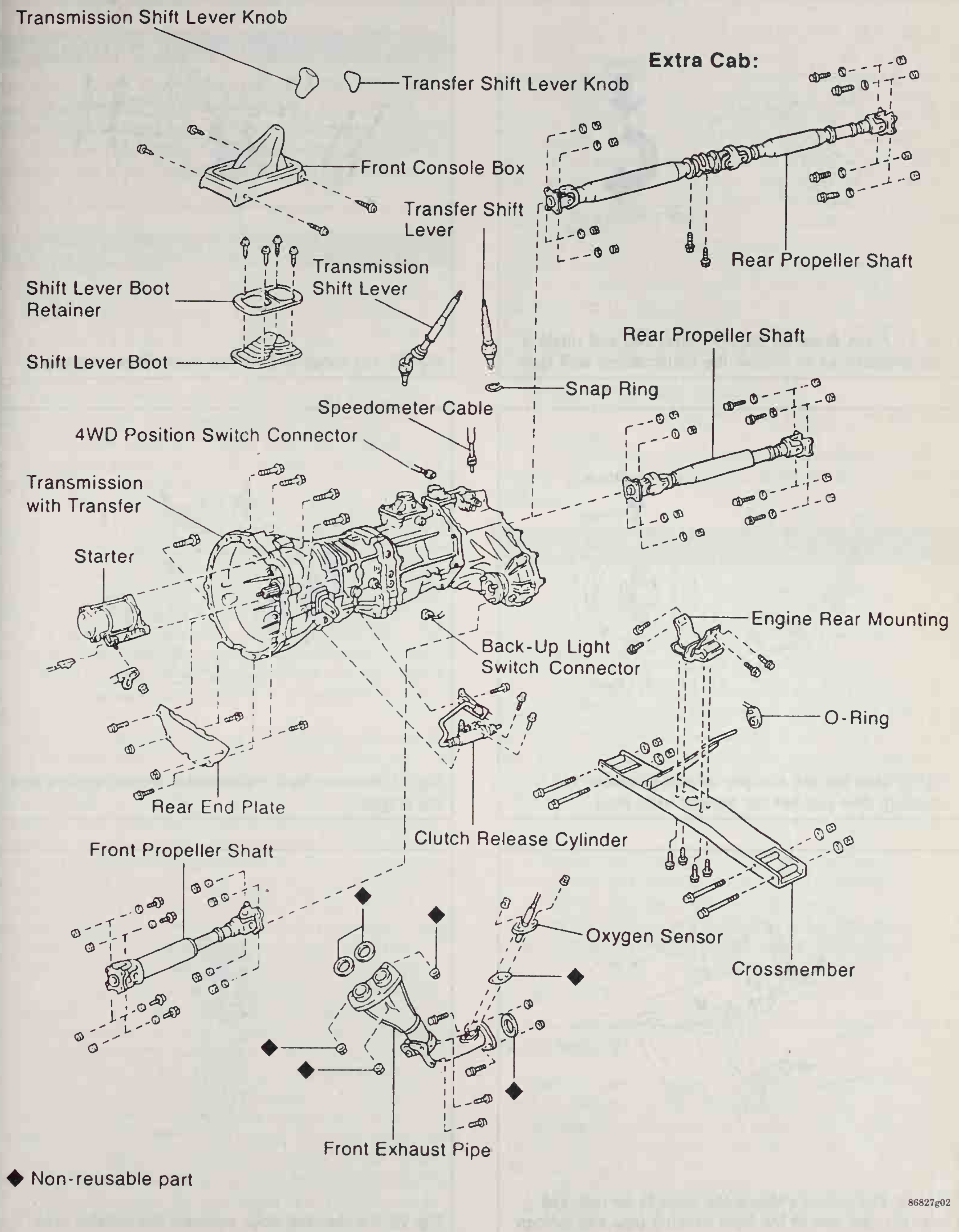

Transmission Shift Lever Knob
Transfer Shift Lever Knob
Extra Cab:
Front Console Box
Transfer Shift Lever
Rear Propeller Shaft
Transmission Shift Lever
Shift Lever Boot Retainer
Shift Lever Boot
Rear Propeller Shaft
Snap Ring
Speedometer Cable
4WD Position Switch Connector
Transmission with Transfer
Starter
Engine Rear Mounting
Back-Up Light Switch Connector
O-Ring
Rear End Plate
Clutch Release Cylinder
Front Propeller Shaft
Oxygen Sensor
Crossmember
Front Exhaust Pipe
◆ Non-reusable part
86827g02

Fig. 16 W59 manual transmission — 4WD Tacoma

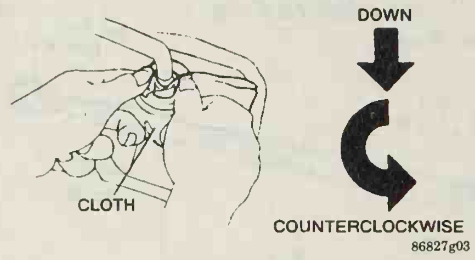

DOWN
CLOTH
COUNTERCLOCKWISE
86827g03

Fig. 17 Press down on the shift lever cap and rotate it counterclockwise to remove the transmission shift lever

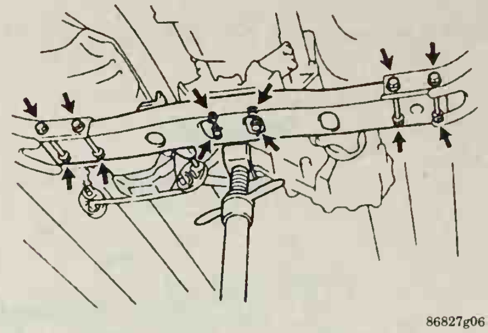


Fig. 20 The crossmember has many bolts retaining it

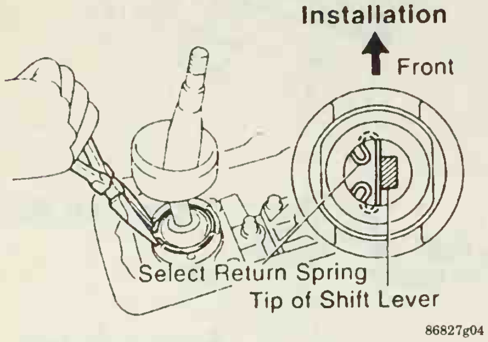

Installation
Front
Select Return Spring
Tip of Shift Lever
86827g04

Fig. 18 With the aid of a pair of pliers, remove the snapring, then pull out the transfer shift lever

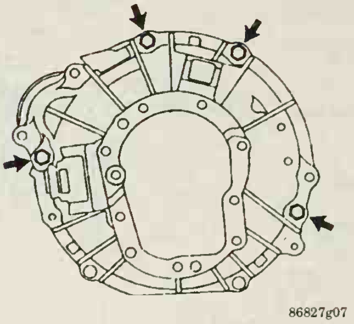


Fig. 21 Remove the 4 transmission mounting bolts from the engine

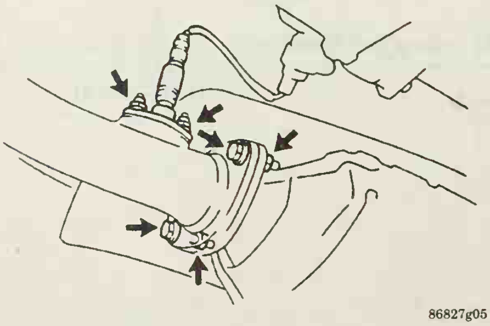


Fig. 19 The arrows indicate the bolts to be removed from the rear end of the front exhaust pipe and oxygen sensor

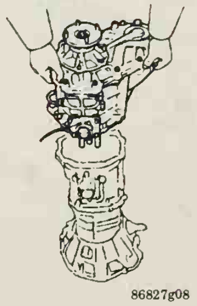


Fig. 22 For the final step, separate the transfer case from the transmission

CLUTCH

**CAUTION

The clutch driven disc may contain asbestos, which has been determined to be a cancer causing agent. Never clean clutch surfaces with compressed air. Avoid inhaling any dust from any clutch surface! When cleaning clutch surfaces, use a commercially available brake cleaning fluid.

Understanding the Clutch

The purpose of the clutch is to disconnect and connect engine power at the transmission. A vehicle at rest requires a lot of engine torque to get all that weight moving. An internal combustion engine does not develop a high starting torque (unlike steam engines) so it must be allowed to operate without any load until it builds up enough torque to move the vehicle. To a point, torque increases with engine rpm. The clutch allows the engine to build up torque by physically disconnecting the engine from the transmission, relieving the engine of any load or resistance.

The transfer of engine power to the transmission (the load) must be smooth and gradual; if it weren't, drive line components would wear out or break quickly. This gradual power transfer is made possible by gradually releasing the clutch pedal. The clutch disc and pressure plate are the connecting link between the engine and transmission. When the clutch pedal is released, the disc and plate contact each other (the clutch is engaged) physically joining the engine and transmission. When the pedal is pushed in, the disc and plate separate (the clutch is disengaged) disconnecting the engine from the transmission.

Most clutch assemblies consists of the flywheel, the clutch disc, the clutch pressure plate, the throw out bearing and fork, the actuating linkage and the pedal. The flywheel and clutch pressure plate (driving members) are connected to the engine crankshaft and rotate with it. The clutch disc is located between the flywheel and pressure plate, and is splined to the transmission shaft. A driving member is one that is attached to the engine and transfers engine power to a driven member (clutch disc) on the transmission shaft. A driving member (pressure plate) rotates (drives) a driven member (clutch disc) on contact and, in so doing, turns the transmission shaft.

There is a circular diaphragm spring within the pressure plate cover (transmission side). In a relaxed state (when the clutch pedal is fully released) this spring is convex; that is, it is dished outward toward the transmission. Pushing in the clutch pedal actuates the attached linkage. Connected to the other end of this is the throw out fork, which hold the throw out bearing. When the clutch pedal is depressed, the clutch linkage pushes the fork and bearing forward to contact the diaphragm spring of the pressure plate. The outer edges of the spring are secured to the pressure plate and are pivoted on rings so that when the center of the spring is compressed by the throw out bearing, the outer edges bow outward and, by so doing, pull the pressure plate in the same direction - away from the clutch disc. This action separates the disc from the plate, disengaging the clutch and allowing the transmission to be shifted into another gear. A coil type clutch return spring attached to the clutch pedal arm permits full release of the pedal. Releasing the pedal pulls the throw out bearing away from the diaphragm spring resulting in a reversal of spring position. As bearing pressure is gradually released from the spring center, the outer edges of the spring bow outward, pushing the pressure plate into closer contact with the clutch disc. As the disc and plate move closer together, friction between the two increases and slippage is reduced until, when full spring pressure is applied (by fully releasing the pedal) the speed of the disc and plate are the same. This stops all slipping, creating a direct connection between the plate and disc which results in the transfer of power from the engine to the transmission. The clutch disc is now rotating with the pressure plate at engine speed and, because it is splined to the transmission shaft, the shaft now turns at the same engine speed.

The clutch is operating properly if:

1. It will stall the engine when released with the vehicle held stationary.
2. The shift lever can be moved freely between 1st and reverse gears when the vehicle is stationary and the clutch disengaged.

Adjustments

PEDAL HEIGHT

➧ See Figure 23

The pedal height measurement is gauged from the angled section of the floorboard to the center of the clutch pedal pad. If necessary, adjust the pedal height by loosening the locknut and turning the pedal stop bolt which is located above the pedal toward the driver's seat. Tighten the locknut after the adjustment.

Correct pedal height from the floor pan sheet (not the carpet) is:

- 1989-95 2WD Pick-Up — 6.0827 in. (154.5mm)
- 1989-95 4WD Pick-Up — 5.9646 in. (151.5mm)
- 1989-95 4Runner — 6.201 in. (157.5mm)
- 1995-96 Tacoma — 6.89-7.28 in. (175.0-185.0mm)
- 1995-96 T100 — 6.087-6.480 in. (154.6-164.6mm)

FREE-PLAY

➧ See Figure 24

Check the pedal free-play to see if it is correct, push in on until the beginning of the clutch resistance is felt. To adjust, loosen the locknut and turn the pushrod until the free-play is correct. Tighten the locknut. After adjusting the free-play, check the pedal height.

- 1989-95 Pick-Up — 0.20-0.59 in. (5.0-15.0mm)
- 1989-95 4Runner — 0.20-0.59 in. (5.0-15.0mm)
- 1995-96 Tacoma — 0.197-0.591 in. (5.0-15.0mm)
- 1993-96 T100 — 0.197-0.591 in. (5.0-15.0mm)

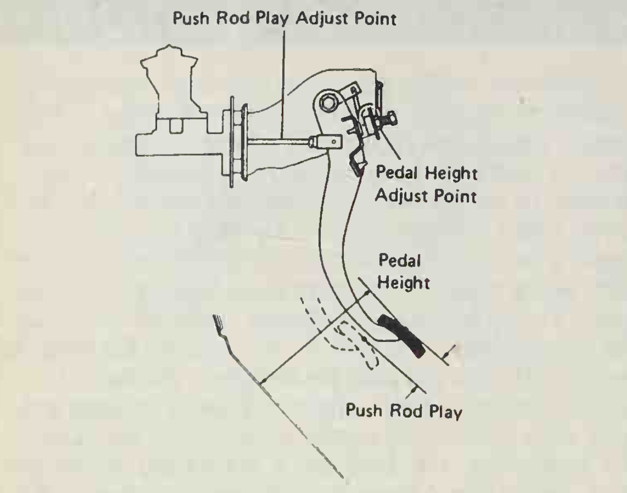


Fig. 23 Pedal height and pushrod play adjustments

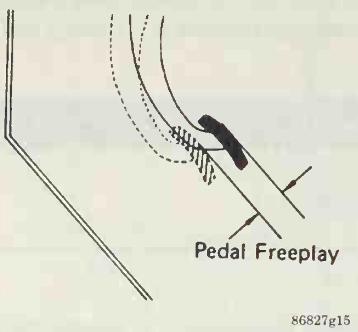


Fig. 24 Free-play is the amount of pedal movement before the clutch engages

PEDAL PUSHROD PLAY

The pedal pushrod play is the distance between the clutch master cylinder piston and the pedal pushrod located above the pedal towards the firewall. Since it is nearly impossible to measure this distance at the source, it must be measured at the pedal pad.

If necessary, adjust the pedal play by loosening the pedal pushrod locknut and turning the pushrod. Tighten the locknut after the adjustment to 0.039-0.197 in. (1.0-5.0mm).

Driven Disc and Pressure Plate

REMOVAL & INSTALLATION

➧ See Figures 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50 and 51

⁂CAUTION

The clutch driven disc may contain asbestos, which has been determined to be a cancer causing agent. Avoid inhaling any dust from any clutch surface! When cleaning clutch surfaces, use a commercially available brake cleaning fluid. Never clean clutch surfaces with compressed air.

1. Remove the transmission.
2. Matchmark the clutch cover (pressure plate) and flywheel, indicating their relationship.
3. Loosen the clutch cover-to-flywheel retaining bolts one turn at a time in a crisscross pattern. The pressure on the clutch disc must be released GRADUALLY.
4. Remove the clutch cover-to-flywheel bolts. Remove the clutch cover and the clutch disc.
5. If the clutch throwout bearing is to be replaced, do so at this time as follows:
   a. Remove the bearing retaining clip(s) and remove the bearing and hub.
   b. Remove the release fork and the boot.
   c. The bearing is press fit to the hub. Turn the bearing by hand while placing it under some pressure; check for freedom of motion and lack of grinding or resistance. The bearing is permanently lubricated and cannot be disassembled or greased.
   d. Clean all parts; lightly grease the input shaft splines and all of the contact points.
   e. Install the bearing/hub assembly, fork, boot, and retaining clip(s) in their original locations.
6. Inspect the flywheel surface for cracks, heat scoring (blue marks), and warpage. If oil is present on the flywheel surface, this indicates that either the engine rear oil seal or the

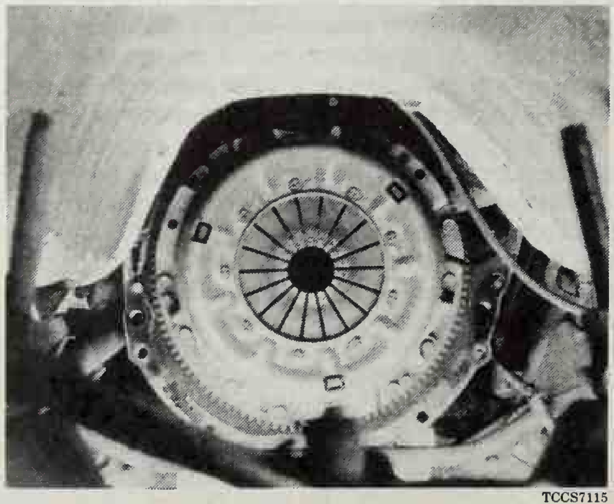


Fig. 25 View of the clutch and pressure plate assembly

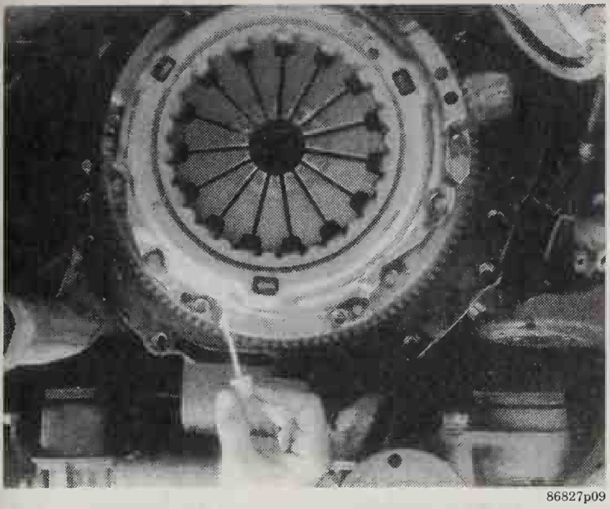

86827p09

Fig. 26 Matchmark the pressure plate and flywheel

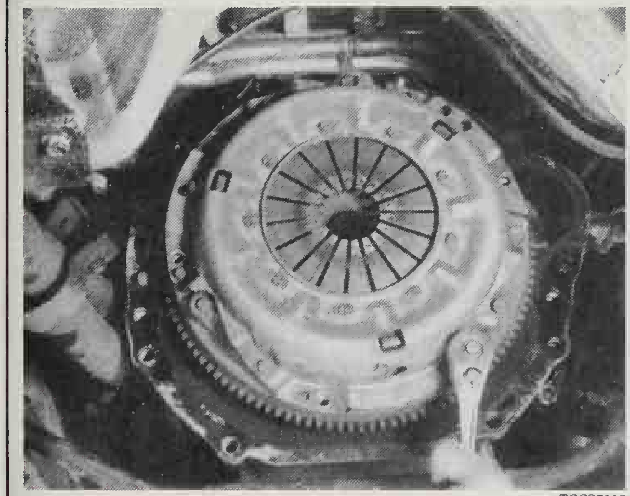

TCCS7116

Fig. 27 Remove the clutch and pressure plate bolts

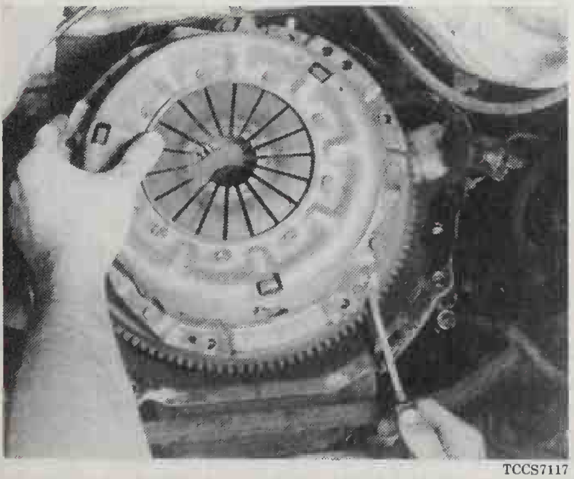

TCCS7117

Fig. 28 Carefully pry the clutch and pressure plate assembly away from the flywheel

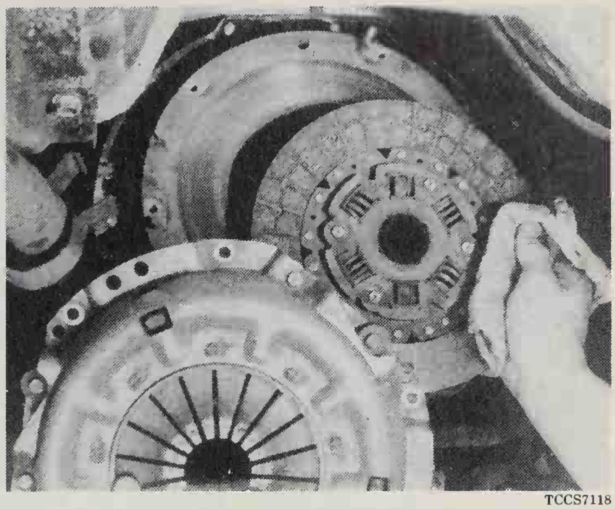

TCCS7118

Fig. 29 Remove the clutch and pressure plate

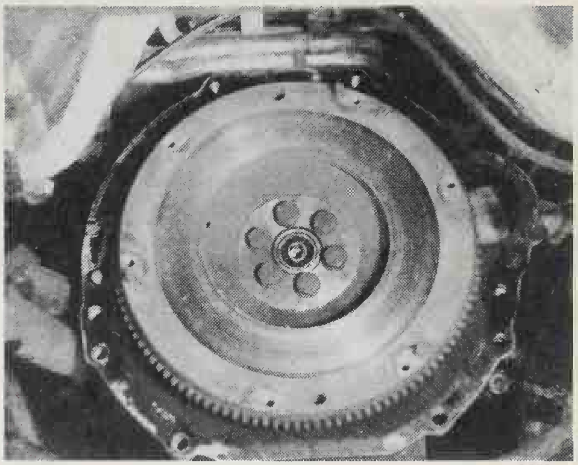

TCCS7119

Fig. 30 View of the flywheel once the clutch assembly is removed

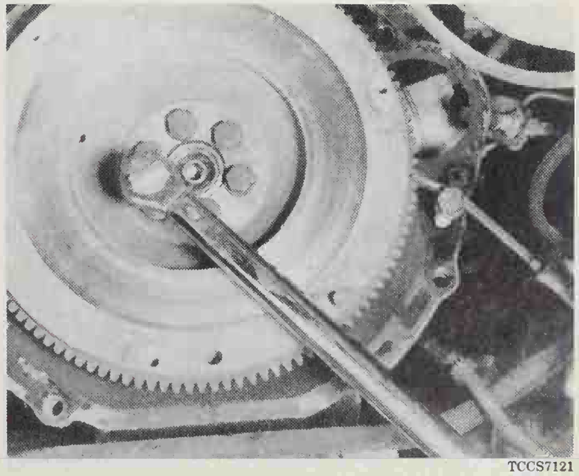
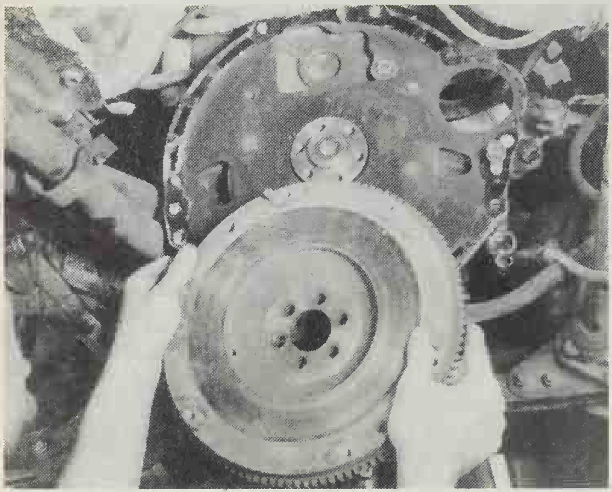
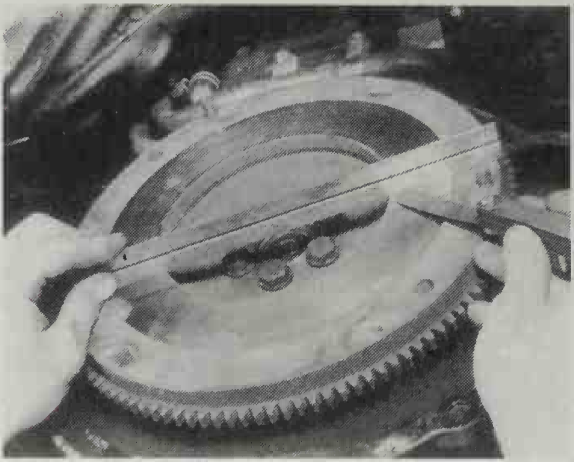

TCCS7121

Fig. 31 Lock the flywheel in place, then remove the flywheel bolts



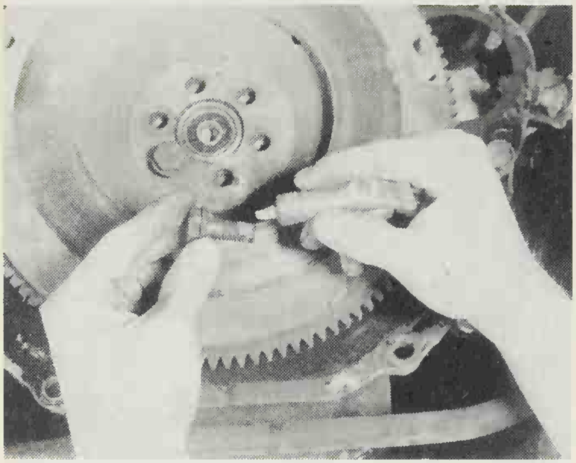
TCCS7122

Fig. 32 Removing the flywheel from the crankshaft



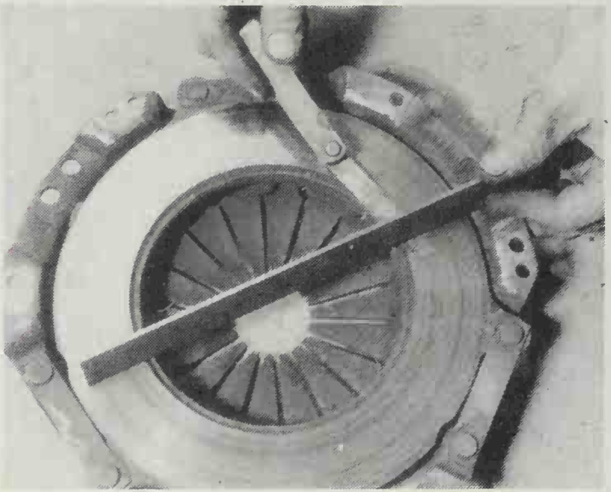
TCCS7125

Fig. 35 Place a straightedge across the flywheel surface, then use a feeler gauge to check for warpage



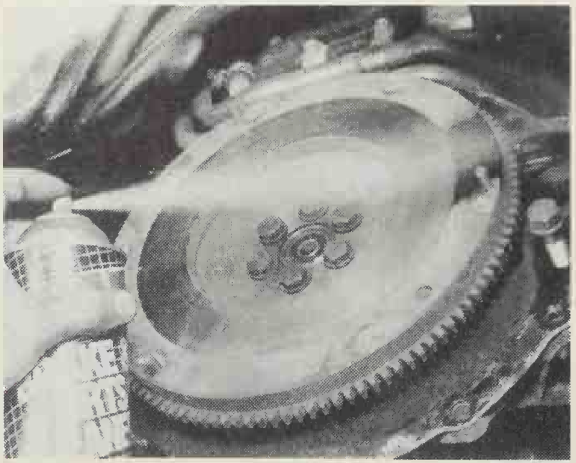
TCCS7123

Fig. 33 Add a threadlocking agent to the flywheel bolts upon installation



TCCS7126

Fig. 36 Checking the pressure plate for excessive wear



TCCS7124

Fig. 34 Be sure that the flywheel surface is clean, before installing the clutch

transmission front oil seal is leaking. If necessary, replace the seal(s). If in doubt concerning the condition of the flywheel, consult an automotive machine shop.

7. Before installing any new parts, make sure that they are clean. During installation, do not get grease or oil on any of the components, as this will shorten clutch life considerably. Grease or fingerprints may be cleaned with an evaporative cleaner such as the type used on brake linings.

To install:

8. Position the clutch disc against the flywheel. The long side of the splined section faces the flywheel.

9. Install the clutch cover over the disc and install the bolts loosely. Align the matchmarks made. If a new or rebuilt clutch cover assembly is installed, use the matchmark on the old cover assembly as a reference.

➡Whenever the clutch disc is replaced, replacement of the pressure plate (clutch cover) and release bearing is highly recommended.

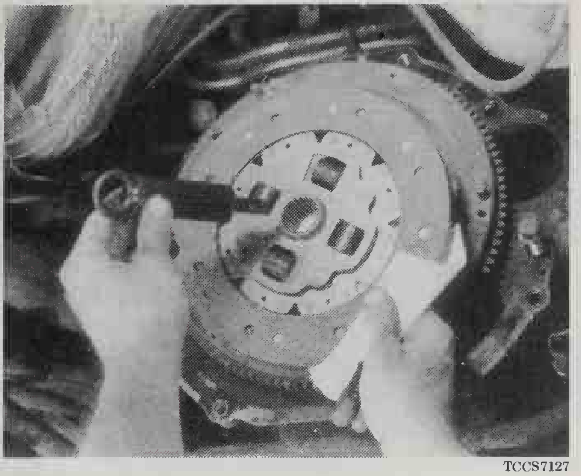

TCCS7127

Fig. 37 Install a clutch alignment arbor, to align the clutch assembly during installation

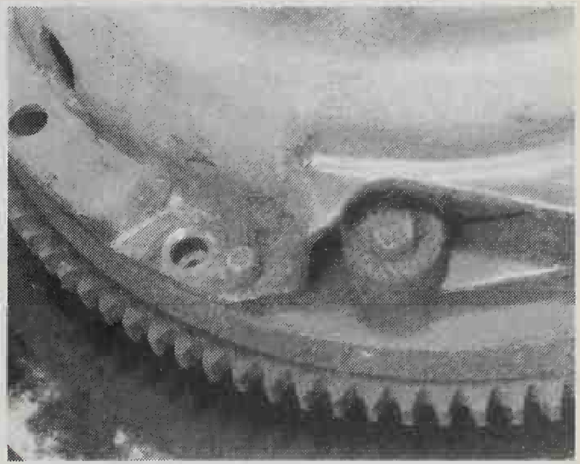

TCCS7130

Fig. 40 Pressure plate-to-flywheel bolt holes should align

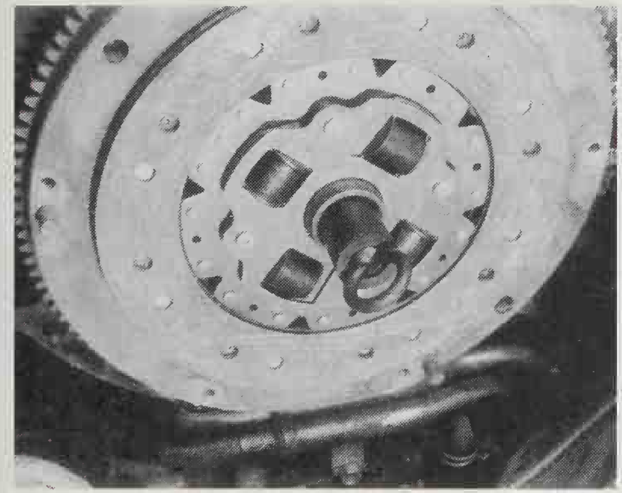

TCCS7128

Fig. 38 Clutch plate installed with the arbor in place

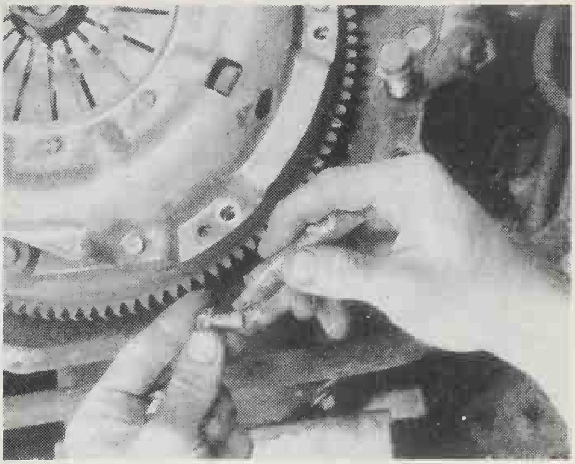

TCCS7131

Fig. 41 Apply locking agent to the clutch assembly bolts

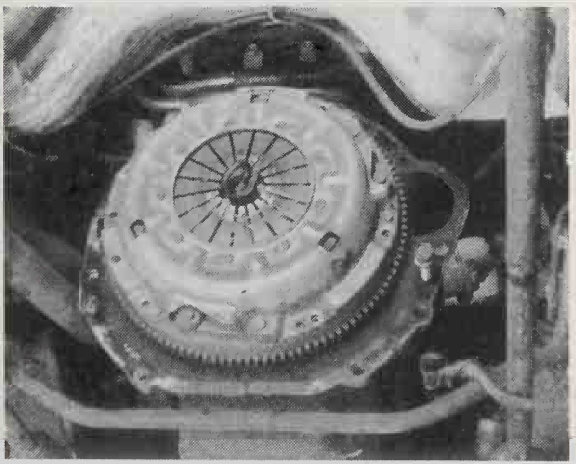

TCCS7129

Fig. 39 Clutch plate and pressure plate installed with the alignment arbor in place

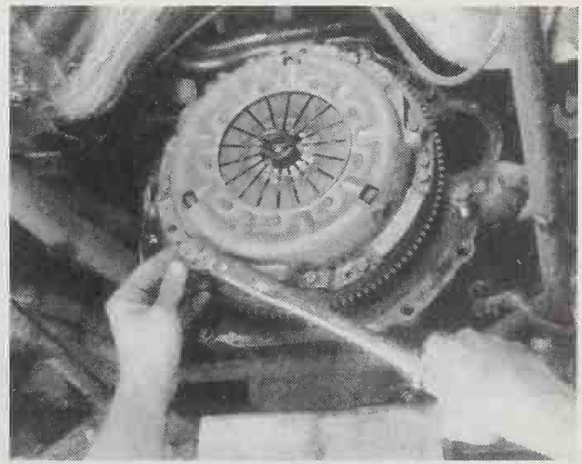

TCCS7133

Fig. 42 Be sure to use a torque wrench to tighten all bolts in a star pattern

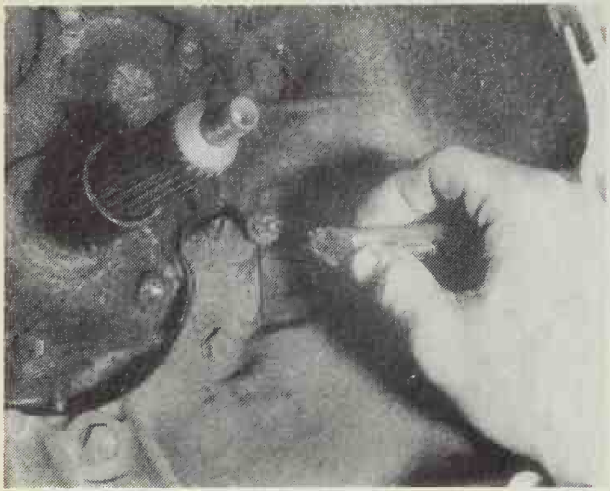

TCCS7134

Fig. 43 Grease the clutch release fork ball

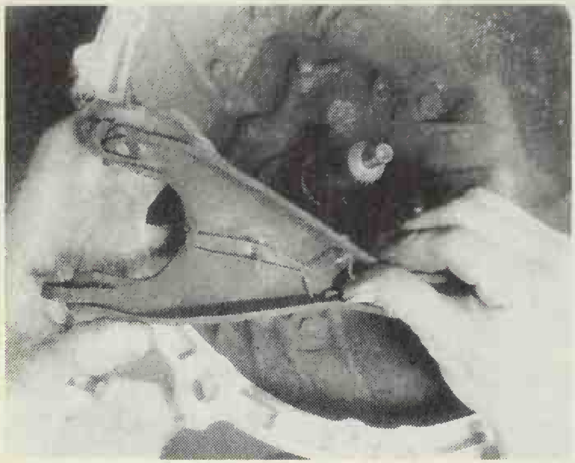

TCCS7135

Fig. 44 View of the clutch release fork; check it for signs of damage

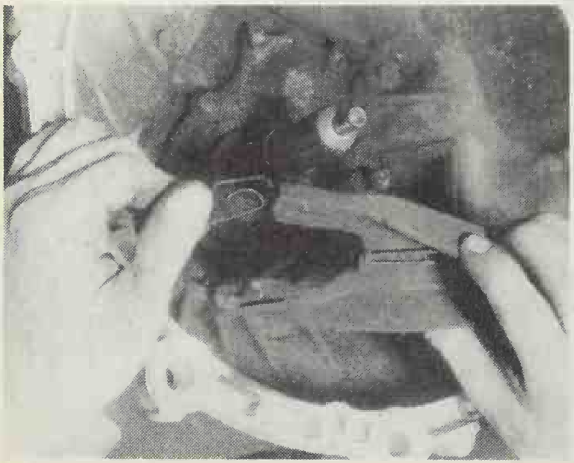

TCCS7136

Fig. 45 View of the clutch release fork bearing clips; make sure these are not bent or broken

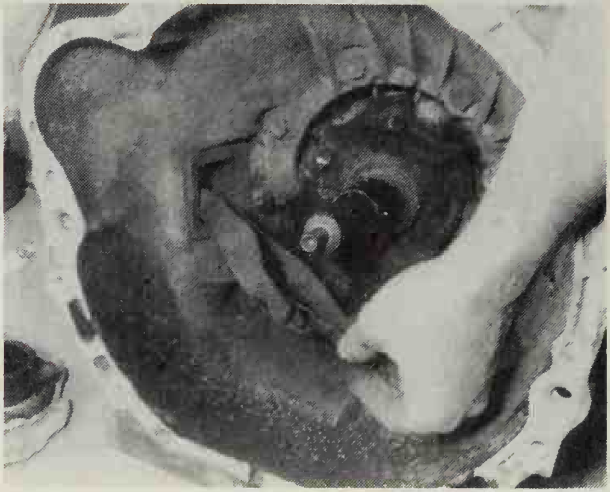

TCCS7137

Fig. 46 Removing the clutch release fork bearing clips

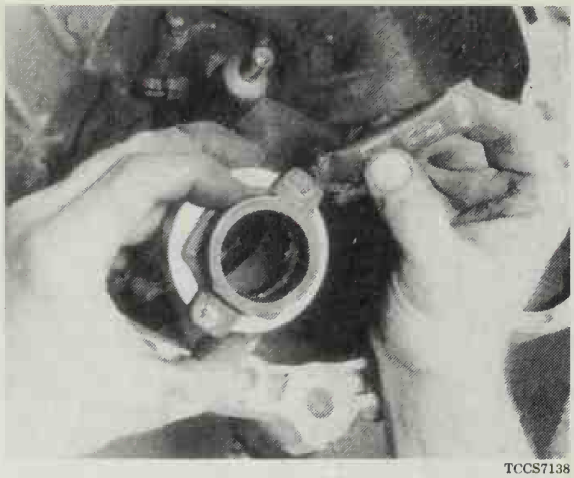

TCCS7138

Fig. 47 Grease the throwout bearing assembly at the outer contact points

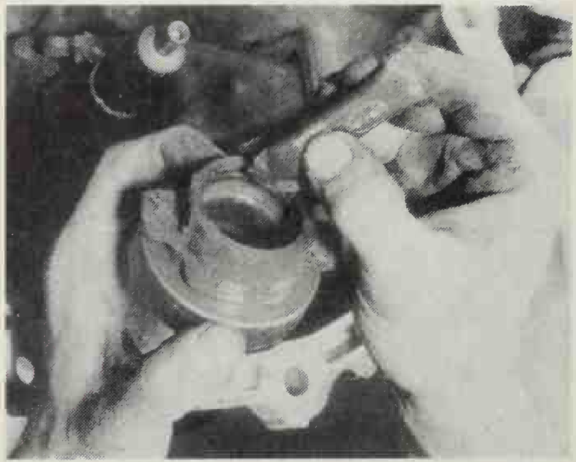

TCCS7139

Fig. 48 Grease the throwout bearing assembly at the inner contact points

10. Align the clutch disc with the flywheel using a clutch aligning tool. These handy tools are available in many auto parts stores at a reasonable price. Do NOT attempt to align the clutch disc by eye; use an alignment tool.
11. With the clutch aligning tool installed, tighten the clutch cover bolts gradually in a star pattern, as is done with lug nuts. Final tighten the bolts to 14 ft. lbs. (19 Nm).
12. Apply molybdenum disulfide grease or multi-purpose grease to the release fork contact points, the pivot and the clutch disc splines. Install the boot, fork, and bearing on the transmission input shaft.
13. Install the transmission.

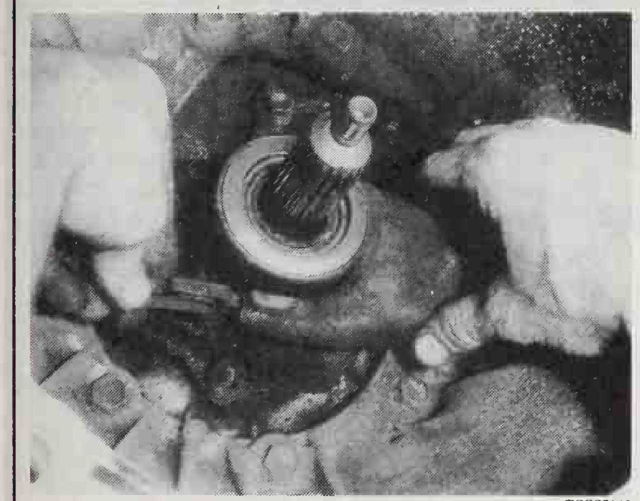

TCCS7140

Fig. 49 Installing the clutch release fork bearing clip

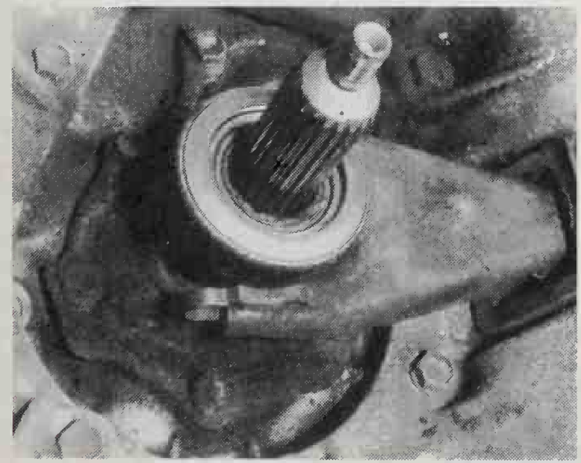

TCCS7141

Fig. 50 View of the clutch release fork assembly installed; be sure all parts move freely

Master Cylinder

REMOVAL & INSTALLATION

➧ **See Figure 52**

1. Remove the clip and pin at the top of the clutch pedal; disconnect the master cylinder pushrod from the clutch pedal.
2. Have a container handy to catch any spillage of fluids. Remove the hydraulic line from the master cylinder, being careful not to damage the fitting.
3. Remove the two bolts holding the master cylinder to the engine compartment.

⁎⁎WARNING

Brake fluid dissolves paint. Do not allow it to drip onto the body when removing the master cylinder.

To install:

4. Install the master cylinder. Partially tighten the hydraulic line, then tighten the cylinder mounting bolts to 9 ft. lbs. (13 Nm).
5. Connect the pushrod to the clutch pedal.
6. Bleed the system. Adjust the clutch pedal.

Slave Cylinder

REMOVAL & INSTALLATION

➧ **See Figure 53**

1. Jack up the front of the truck and support it on jackstands.
2. Remove the tension spring on the clutch fork.
3. Remove the hydraulic line from the slave cylinder. Be careful not to damage the fitting.
4. Remove the mounting bolts and withdraw the cylinder.

To install:

5. Place the cylinder in position, then install the bolts. Tighten to 9 ft. lbs. (13 Nm).
6. Install the hydraulic line from the master cylinder.
7. Bleed the system.

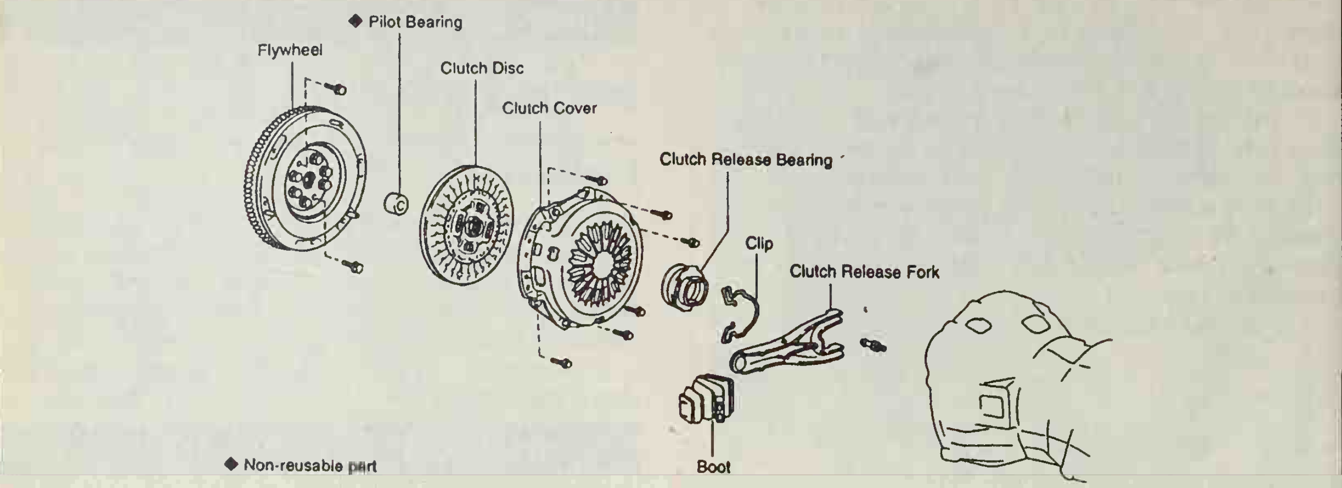
HYDRAULIC SYSTEM BLEEDING

This operation must be performed any time the clutch master or slave cylinder has been removed or if any of the hydraulic lines have been opened.

⁎⁎WARNING

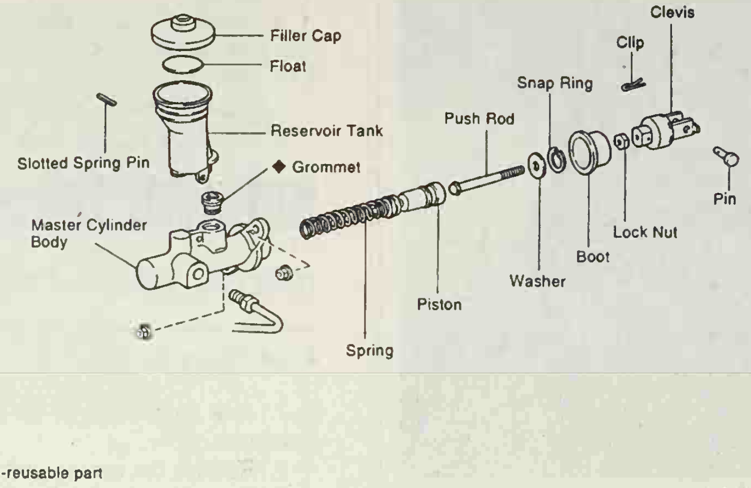
Do not spill brake fluid on the bodywork of the vehicle; it will destroy the paint. If fluid is spilled, immediately wash the surface with plenty of clean water.

1. Fill the master cylinder reservoir with brake fluid.


◆ Pilot Bearing
Flywheel
Clutch Disc
Clutch Cover
Clutch Release Bearing
Clip
Clutch Release Fork
Boot
◆ Non-reusable part

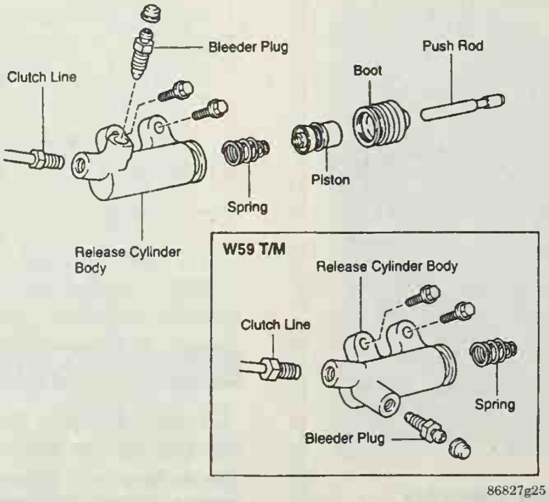
86827g16

Fig. 51 Exploded view of the common clutch set-up


Clevis
Filler Cap
Clip
Float
Snap Ring
Reservoir Tank
Push Rod
Slotted Spring Pin
◆ Grommet
Pin
Master Cylinder Body
Lock Nut
Boot
Washer
Piston
Spring
◆ Non-reusable part

86827g17

Fig. 52 Exploded view of the clutch master cylinder


Bleeder Plug
Push Rod
Clutch Line
Boot
Piston
Spring
Release Cylinder Body
W59 T/M
Release Cylinder Body
Clutch Line
Spring
Bleeder Plug

86827g25

Fig. 53 Exploded view of the clutch slave cylinder

2. Remove the cap on the bleeder screw on the clutch slave cylinder. Install a clear vinyl hose on the fitting; place the other end submerged in a clear glass jar partially filled with brake fluid.
3. Have an assistant pump the clutch pedal slowly several times. After several pumps, hold the pedal down and open the bleeder, allowing fluid to flow into the jar. Close the bleeder valve almost immediately after opening it. Release the pedal only after the bleeder is closed.
4. Repeat the process until the fluid in the hose contains no air bubbles. tube. When there are no more air bubbles in the system, tighten the plug fully with the pedal depressed. Replace the plastic cap.
5. Fill the clutch master cylinder reservoir to the correct level with brake fluid.
6. Check the system for leaks.

AUTOMATIC TRANSMISSION

Understanding Automatic Transmissions

The automatic transmission allows engine torque and power to be transmitted to the rear wheels within a narrow range of engine operating speeds. It will allow the engine to turn fast enough to produce plenty of power and torque at very low speeds, while keeping it at a sensible rpm at high vehicle speeds (and it does this job without driver assistance). The transmission uses a light fluid as the medium for the transmission of power. This fluid also works in the operation of various hydraulic control circuits and as a lubricant. Because the transmission fluid performs all of these functions, trouble within the unit can easily travel from one part to another. For this reason, and because of the complexity and unusual operating principles of the transmission, a very sound understanding of the basic principles of operation will simplify troubleshooting.

TORQUE CONVERTER

➧ **See Figure 54**

The torque converter replaces the conventional clutch. It has three functions:

1. It allows the engine to idle with the vehicle at a standstill, even with the transmission in gear.
2. It allows the transmission to shift from range-to-range smoothly, without requiring that the driver close the throttle during the shift.
3. It multiplies engine torque to an increasing extent as vehicle speed drops and throttle opening is increased. This has the effect of making the transmission more responsive and reduces the amount of shifting required.

The torque converter is a metal case which is shaped like a sphere that has been flattened on opposite sides. It is bolted to the rear end of the engine's crankshaft. Generally, the entire metal case rotates at engine speed and serves as the engine's flywheel.

The case contains three sets of blades. One set is attached directly to the case. This set forms the torus or pump. Another set is directly connected to the output shaft, and forms the turbine. The third set is mounted on a hub which, in turn, is mounted on a stationary shaft through a one-way clutch. This third set is known as the stator.

A pump, which is driven by the converter hub at engine speed, keeps the torque converter full of transmission fluid at all times. Fluid flows continuously through the unit to provide cooling.

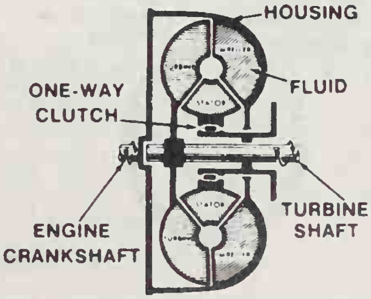
Under low speed acceleration, the torque converter functions as follows:

The torus is turning faster than the turbine. It picks up fluid at the center of the converter and, through centrifugal force, slings it outward. Since the outer edge of the converter moves faster than the portions at the center, the fluid picks up speed.

The fluid then enters the outer edge of the turbine blades. It then travels back toward the center of the converter case along the turbine blades. In impinging upon the turbine blades, the fluid loses the energy picked up in the torus.

If the fluid was now returned directly into the torus, both halves of the converter would have to turn at approximately the same speed at all times, and torque input and output would both be the same.

In flowing through the torus and turbine, the fluid picks up two types of flow, or flow in two separate directions. It flows through the turbine blades, and it spins with the engine. The stator, whose blades are stationary when the vehicle is being accelerated at low speeds, converts one type of flow into another. Instead of allowing the fluid to flow straight back into the torus, the stator's curved blades turn the fluid almost 90° toward the direction of rotation of the engine. Thus the fluid does not flow as fast toward the torus, but is already spinning when the torus picks it up. This has the effect of allowing the torus to turn much faster than the turbine. This difference in speed may be compared to the difference in speed between the smaller and larger gears in any gear train. The result is that engine power output is higher, and engine torque is multiplied.



TCCS7011

Fig. 54 The torque converter, which is rotated by the engine's crankshaft, turns the impeller. The impeller then spins the turbine, which gives motion to the turbine shaft, thereby driving the gears

As the speed of the turbine increases, the fluid spins faster and faster in the direction of engine rotation. As a result, the ability of the stator to redirect the fluid flow is reduced. Under cruising conditions, the stator is eventually forced to rotate on its one-way clutch in the direction of engine rotation. Under these conditions, the torque converter begins to behave almost like a solid shaft, with the torus and turbine speeds being almost equal.

PLANETARY GEARBOX

➧ **See Figures 55, 56 and 57**

The ability of the torque converter to multiply engine torque is limited. Also, the unit tends to be more efficient when the turbine is rotating at relatively high speeds. Therefore, a planetary gearbox is used to carry the power output of the turbine to the driveshaft.

Planetary gears function very similarly to conventional transmission gears. However, their construction is different in that three elements make up one gear system, and, in that all three elements are different from one another. The three elements are: an outer gear that is shaped like a hoop, with teeth cut into the inner surface; a sun gear, mounted on a shaft and located at the very center of the outer gear; and a set of three planet gears, held by pins in a ring-like planet carrier, meshing with both the sun gear and the outer gear. Either the outer gear or the sun gear may be held stationary, providing more than one possible torque multiplication factor for each set of gears. Also, if all three gears are forced to rotate at the same speed, the gearset forms, in effect, a solid shaft.

Most automatics use the planetary gears to provide various reductions ratios. Bands and clutches are used to hold various portions of the gearsets to the transmission case or to the shaft on which they are mounted. Shifting is accomplished, then, by changing the portion of each planetary gearset which is held to the transmission case or to the shaft.

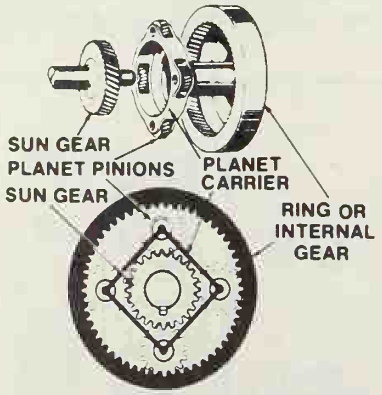


Fig. 55 Planetary gears work in a similar fashion to manual transmission gears, but are composed of three parts

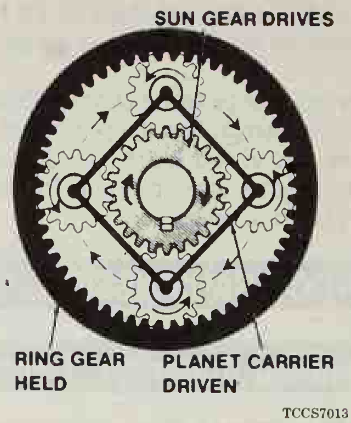


Fig. 56 Planetary gears in the maximum reduction (low) range. The ring gear is held and a lower gear ratio is obtained

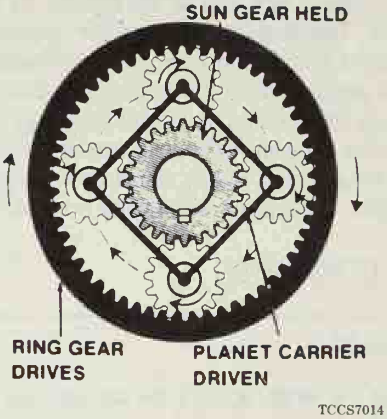


Fig. 57 Planetary gears in the minimum reduction (drive) range. The ring gear is allowed to revolve, providing a higher gear ratio

SERVOS AND ACCUMULATORS

➧ **See Figure 58**

The servos are hydraulic pistons and cylinders. They resemble the hydraulic actuators used on many other machines, such as bulldozers. Hydraulic fluid enters the cylinder, under pressure, and forces the piston to move to engage the band or clutches.

The accumulators are used to cushion the engagement of the servos. The transmission fluid must pass through the accumulator on the way to the servo. The accumulator housing contains a thin piston which is sprung away from the discharge passage of the accumulator. When fluid passes through the accumulator on the way to the servo, it must move the piston against spring pressure, and this action smooths out the action of the servo.

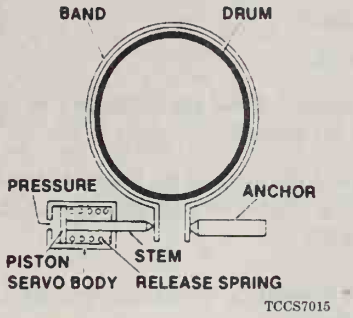


Fig. 58 Servos, operated by pressure, are used to apply or release the bands, to either hold the ring gear or allow it to rotate

HYDRAULIC CONTROL SYSTEM

The hydraulic pressure used to operate the servos comes from the main transmission oil pump. This fluid is channeled to the various servos through the shift valves. There is generally a manual shift valve which is operated by the transmission selector lever and an automatic shift valve for each automatic upshift the transmission provides.

➡Many new transmissions are electronically controlled. On these models, electrical solenoids are used to better control the hydraulic fluid. Usually, the solenoids are regulated by an electronic control module.

There are two pressures which affect the operation of these valves. One is the governor pressure which is effected by vehicle speed. The other is the modulator pressure which is effected by intake manifold vacuum or throttle position. Governor pressure rises with an increase in vehicle speed, and modulator pressure rises as the throttle is opened wider. By responding to these two pressures, the shift valves cause the upshift points to be delayed with increased throttle opening to make the best use of the engine's power output.

Most transmissions also make use of an auxiliary circuit for downshifting. This circuit may be actuated by the throttle linkage the vacuum line which actuates the modulator, by a cable or by a solenoid. It applies pressure to a special downshift surface on the shift valve or valves.

The transmission modulator also governs the line pressure, used to actuate the servos. In this way, the clutches and bands will be actuated with a force matching the torque output of the engine.

Identification

The A43D is a fully automatic 2WD, four speed transmission with electrically engaged overdrive. It was first offered as an option on 1981 models and is available through the current model year in trucks and is now offered in the Tacoma. The A44F is the 4WD application found in 1990 and 1991 4Runners.

The A340E, A340, and A340H are also fully automatic transmissions, but rely on electronic computer control rather than the conventional reliance on internal oil pressures. Because of the electronic controls, these units are referred to as Electronically Controlled Transmissions (ECT). On 1989-96 models, these units were offered in the Pick-Up, 4Runner, T100 and Tacoma.

The A340E contains a lock-up torque converter and is coupled to the 3VZ-E engine. The A340F employs a mechanically controlled transfer unit for 4WD applications, while the A340H, also used in 4WD vehicles, is coupled to an electrically controlled transfer case.

1989-92 Land Cruisers were equipped with an A440F transmission which is similar to the A43D. The A440F contains a lock-up torque converter and is coupled to a 2-speed transfer unit. The A442F is used in the Land Cruiser from 1993-95. In 1996, the A343F transmission was used.

Adjustments

THROTTLE CABLE

Pick-Up and 4Runner

1. Remove the air cleaner assembly.
2. Push the accelerator to the floor and check that the throttle plate opens fully. If not, adjust the accelerator linkage so that it does.
3. Push back the rubber boot from the throttle cable which runs down to the transmission. Loosen the throttle cable adjustment nuts so that the cable housing can be adjusted.
4. Fully open the throttle by having an assistant press the accelerator all the way to the floor.
5. Adjust the cable housing so that, with the throttle wide open, the distance between the end of the rubber boot and the cable stopper is 0-0.04 in. (0-1mm).
6. Tighten the nuts and double check the adjustment. Install the rubber boot and the air cleaner.

Land Cruiser

A440F

1. Inspect the throttle cable and its mounts. Neither the cable nor the mounts should be deformed or bent.
2. With the throttle fully closed, measure the distance between the end of the boot and the stopper. The correct distance is 0.020-0.059 in. (0.5-1.5mm).
3. Have an assistant open the throttle fully. Remeasure the distance. Correct distance is 1.26-1.34 in. (32-34mm).
4. If distances are not correct, adjust the cable via the adjusting nuts at the bracket.

A442F AND A343F

1. Inspect the throttle cable and its mounts. Neither the cable nor the mounts should be deformed or bent.
2. With the throttle fully closed, measure the distance between the end of the boot and the stopper. Correct distance is 0-0.04 in. (0-1mm).
3. If distances are not correct, adjust the cable via the adjusting nuts at the bracket.

SHIFT LEVER POSITION

1. Loosen or disconnect the nut holding the horizontal shift rod to the bottom of the shift selector.
2. Move the now loosened or removed rod downward or towards the back of the vehicle. This will cause the shift lever (on the transmission case) to move into approximately the 9 o'clock or horizontal position.
3. On A43D, A44D and A340F transmissions, move the horizontal rod upwards or towards the front until the 3rd notch is engaged. This should put the transmission in **N** and bring the small arm at the transmission near the vertical position.
4. For A340F, A340H, A440, A442F and A343F units, return or move the arm until the 2nd notch is engaged. This should put the transmission in **N** and bring the small arm at the transmission near the vertical position.
5. Set the shift selector inside the vehicle to the **N** position.
6. Have an assistant hold the shift selector lightly towards the **R** position. Reconnect and/or adjust the linkage to the lower part of the shift selector and tighten the bolts.
7. Start the engine and make sure that the vehicle moves forward when shifted from **N** into the **D** range and moves rearward when shifted into **R**.

TRANSFER CASE LINKAGE

This adjustment is only possible on the A340E and A340H transmissions.

1. Shift the transfer case lever to the **H2** position.
2. Disconnect the No. 1 transfer case linkage from the cross shaft.
3. Position the transfer case indicator switch to the **H2** position.
4. Connect the No. 1 transfer case linkage to the cross shaft.

TRANSFER POSITION SWITCH

This adjustment is only possible on the A340E and A340H transmissions.

1. Loosen the transfer case position switch bolt and set the shift position to the **L4** position.
2. Unplug the electrical connector.
3. Connect an ohmmeter between the terminals and adjust the switch so there is continuity.
4. Connect the electrical lead and tighten the switch bolt to 48 inch lbs. (5 Nm).
5. Check the idle speed.

Neutral Safety Switch

The neutral safety switch prevents the vehicle from starting unless the gearshift selector is in either the **P** or **N** positions. If the vehicle will start in any other positions, adjustment or replacement of the switch is required.

REMOVAL & INSTALLATION

A340E and A340F

➧ See Figure 59

➡On some models it will be necessary to remove the oil cooler pipes for access.

1. Disconnect the harness for the neutral safety switch.
2. Pry off the washer and remove the nut, then remove the bolt for the switch.

To install:

3. Attach the switch to the vehicle with the bolt, tighten to 9 ft. lbs. (13 Nm).
4. Install a new lock plate and nut. Tighten the nut to 35 inch lbs. (4 Nm).
5. Stake the nut with the lock plate.
6. Adjust the neutral safety switch.
7. Attach the harness to the switch.
8. Attach the oil cooler pipes.

A43D

➧ See Figures 60 and 61

1. Unstake the lockwasher.
2. Remove the nut and bolt, then the lockwasher and grommet.
3. Slide the switch off the manual lever shaft.

To install:

4. Insert the neutral safety switch onto the manual lever shaft, then temporarily tighten the adjusting bolt.
5. Install the grommet and a new lockwasher. Install and tighten the nut to 35 inch lbs. (4 Nm).
6. Using the control shaft lever, turn the manual valve lever shaft forwards and return two notches. It is now in neutral.
7. Align the switch basic line and the switch groove, then tighten the adjusting bolt. Tighten to 48 inch lbs. (5 Nm).
8. Bend the tabs of the lockwasher over the nut.

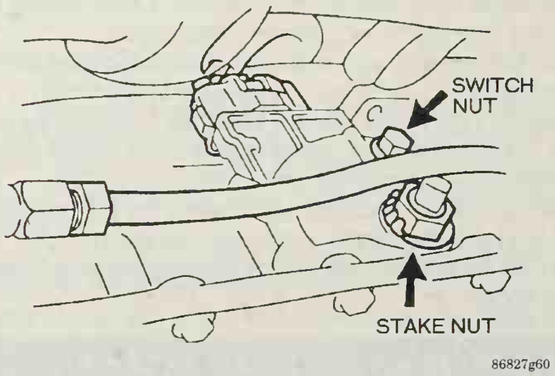


Fig. 59 Neutral safety switch nut locations

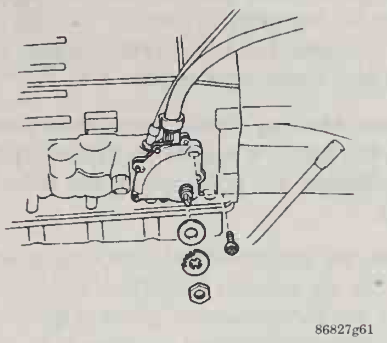


Fig. 60 Exploded view of neutral safety switch mounting

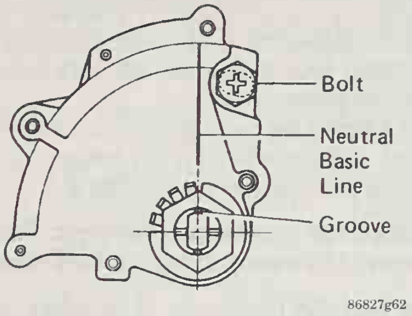


Fig. 61 Align the switch basic line and the switch groove, then tighten the adjusting bolt to 48 inch lbs. (5 Nm)

ADJUSTMENT

1. Loosen the neutral start switch bolt.
2. Place the gearshift selector lever in the **N** position.
3. Align the shaft groove of the switch with the neutral Basic line. Hold the switch in this position and tighten the switch bolts on the A43D to 48 inch lbs. (6 Nm) and all others to 9 ft. lbs. (13 Nm).
4. With the parking brake set and the brake pedal fully applied, attempt to start the engine in each shifter range. The engine should only start in **N** or **P**.

Extension Housing Seal

REMOVAL & INSTALLATION

➧ See Figures 62 and 63

Removal of the extension housing seal is only possible on the A43D, A44D and A340E transmissions.

1. Elevate and safely support the vehicle.
2. Position a catch pan below the work area to contain spilled fluid.
3. Remove the driveshaft.
4. Clean the extension housing area thoroughly before removing the seal. No dirt must be allowed to enter the transmission during replacement.
5. Using a seal extractor such as tool 09308-10010 or equivalent, remove the seal.

To install:

6. Use a seal driver such as tool 09325-20010 or equivalent. Drive the new seal into place until it seats.
7. Install the driveshaft.
8. Lower the vehicle and start the engine. With the brake applied, shift the transmission through each position, pausing long enough to allow the gear to fully engage. Place the selector in **P** and check the fluid level, topping the fluid as needed. Do NOT overfill the fluid.

Transmission Assembly

REMOVAL & INSTALLATION

Pick-Up and 4Runner

A43D, A44D AND A340E

➧ See Figures 64, 65, 66 and 67

1. Disconnect the cables at the battery, negative first.
2. Remove the air cleaner assembly.

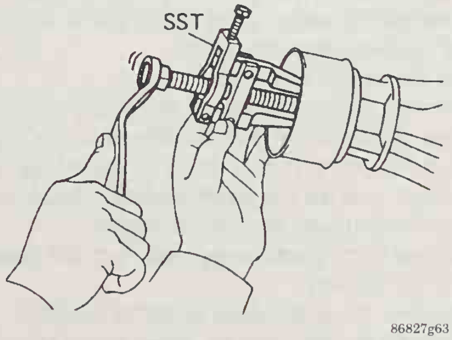


Fig. 62 Use SST 09308-10010 or equivalent to remove the extension housing seal

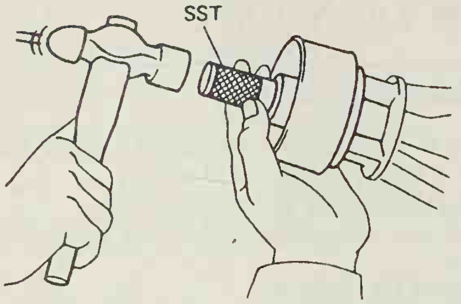


Fig. 63 Upon replacement, tap on the seal driver to insert the seal as far as it will go

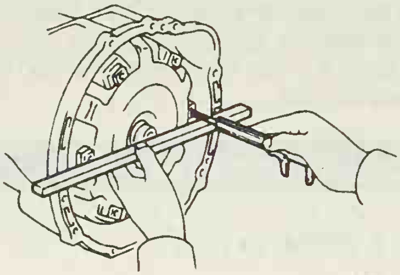


Fig. 64 To help ensure proper installation, measure the distance between the torque converter mounting lugs and the front mounting face of the transmission

3. Disconnect the transmission throttle cable.
4. Raise the vehicle and support it safely with jackstands. Double check the security and placement of the stands.
5. Unplug the wiring connectors near the starter.
6. Disconnect the starter wiring at the starter. Unbolt the starter and remove it from the vehicle.
7. Drain the transmission fluid.
8. Matchmark the rear driveshaft flange and the differential pinion flange. These marks must be aligned during installation.
9. Unbolt the rear driveshaft flange. If the vehicle has a two piece driveshaft, remove the center bearing bracket-to-frame bolts. Remove the driveshaft from the vehicle.
10. Disconnect the speedometer cable from the transmission and tie it out of the way.
11. Disconnect the shift linkage at the transmission.
12. Disconnect the exhaust pipe clamp at the bell housing and remove the transmission dipstick and oil filler tube.
13. Disconnect the transmission oil cooler lines at the transmission.
14. Support the transmission using a jack with a wooden block placed between the jack and the transmission pan. Do not raise the transmission, just raise the jack until the wooden block touches the transmission pan.
15. Place a wooden block (or blocks) between the engine oil pan and the front frame crossmember.

➡The wooden block(s) should be no more than about 0.2 in. (6mm) away from the engine so that when the engine is lowered, damage will not occur to any underhood components.

16. Remove the transmission mount-to-crossmember bolts.
17. Raise the transmission SLIGHTLY, just enough to take the weight of the transmission off of the crossmember. Remove the crossmember-to-frame mounting bolts and remove the crossmember from the vehicle. For vehicles with the A43D, remove the bracket and rear transmission mount.
18. Slowly lower the transmission until the engine rests on the wooden block placed earlier.
19. Remove the engine undercover in order to gain access to the engine crankshaft pulley.
20. Remove the rubber plugs from the service holes located at the rear of the engine in order to gain access to the torque converter bolts.
21. Rotate the crankshaft as necessary to remove the torque converter retaining bolts. Access to these bolts is through the service holes mentioned earlier.
22. Obtain a bolt of the same dimensions as the torque converter bolts. Cut the head off of the bolt and cut a screwdriver slot in the bolt opposite the threaded end.

➡This modified bolt is used as a guide pin. Two guide pins are needed to properly install the transmission.

23. Thread the guide pin into one of the torque converter bolt holes. The guide pin will help keep the converter with the transmission.
24. Remove the transmission-to-engine mounting bolts.
25. Carefully move the transmission rearward by prying on the guide pin through the service hole.

➡As soon as the transmission is away from the engine about 0.1 in. (3mm), feed wire through the front of the transmission and secure the wire in order to keep the converter attached to the transmission. Also, try to keep the nose of the transmission pointed upward SLIGHTLY to help keep the converter in place.

26. Pull the transmission rearward and lower it out of the vehicle.

➡Do not allow the attached cables to catch on any components during removal.

27. With the transmission out of the vehicle, remove the torque converter as follows:
    a. Place a drain pan under the front of the transmission.
    b. Pull the converter straight off the transmission and allow the fluid to drain.

➡Prior to installation of the transmission, Toyota recommends checking the torque converter and flywheel run-out dimensions. If either of these run-out limits are beyond the maximum allowable limits, excessive wear of the front transmission seal will occur.

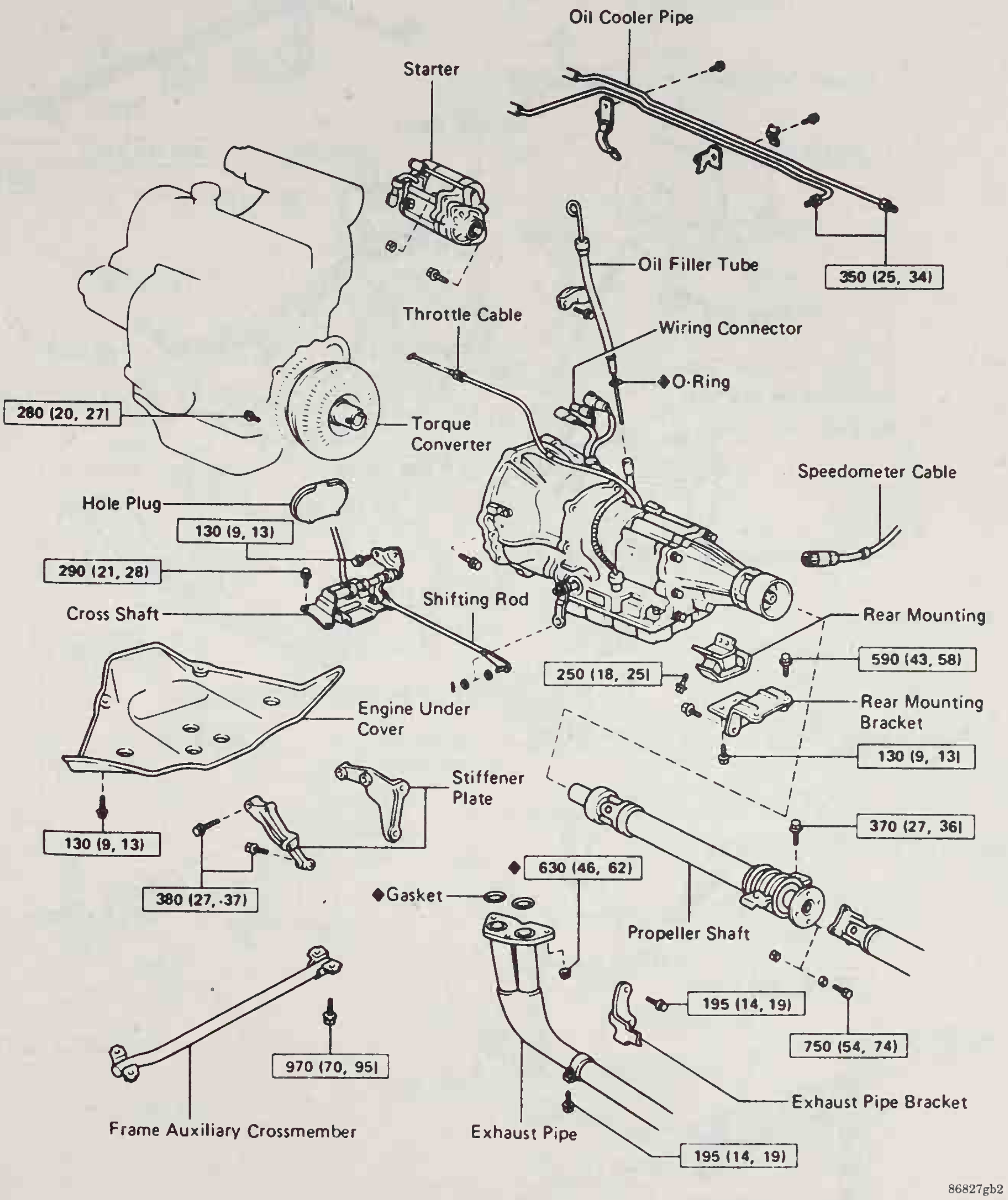

Oil Cooler Pipe
Starter
350 (25, 34)
Oil Filler Tube
Throttle Cable
Wiring Connector
◆O-Ring
280 (20, 27)
Torque Converter
Speedometer Cable
Hole Plug
130 (9, 13)
290 (21, 28)
Cross Shaft
Shifting Rod
Rear Mounting
590 (43, 58)
250 (18, 25)
Engine Under Cover
Rear Mounting Bracket
130 (9, 13)
Stiffener Plate
370 (27, 36)
130 (9, 13)
◆ 630 (46, 62)
380 (27, 37)
◆Gasket
Propeller Shaft
195 (14, 19)
750 (54, 74)
970 (70, 95)
Exhaust Pipe Bracket
Frame Auxiliary Crossmember
Exhaust Pipe
195 (14, 19)
86827gb2

Fig. 65 Exploded view of the A43D transmission and components to be removed

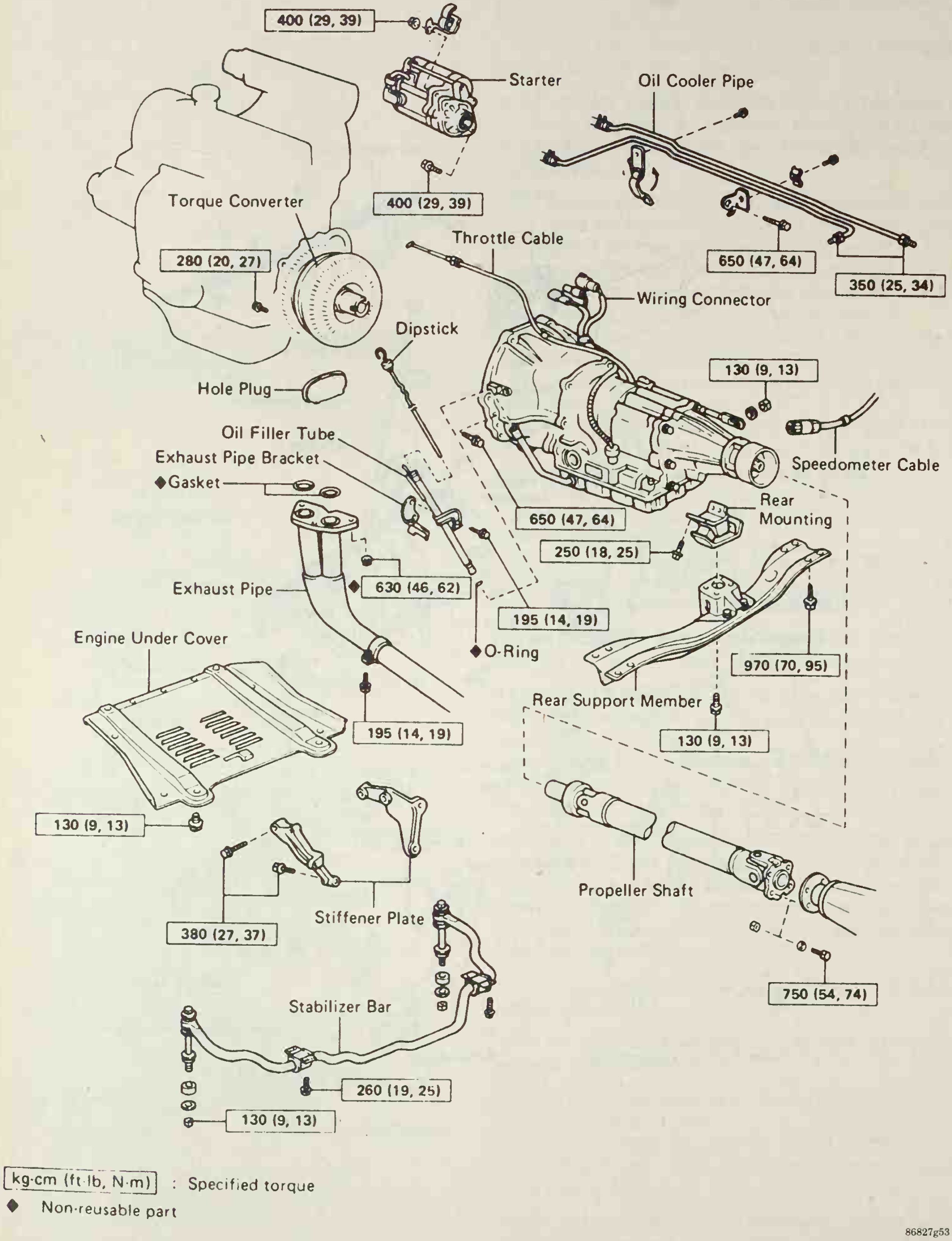

400 (29, 39)
Starter
Oil Cooler Pipe
400 (29, 39)
Torque Converter
280 (20, 27)
Throttle Cable
650 (47, 64)
350 (25, 34)
Wiring Connector
Dipstick
Hole Plug
130 (9, 13)
Oil Filler Tube
Exhaust Pipe Bracket
◆Gasket
Speedometer Cable
650 (47, 64)
Rear Mounting
250 (18, 25)
◆ 630 (46, 62)
Exhaust Pipe
195 (14, 19)
◆O-Ring
Engine Under Cover
970 (70, 95)
Rear Support Member
195 (14, 19)
130 (9, 13)
130 (9, 13)
Propeller Shaft
Stiffener Plate
380 (27, 37)
750 (54, 74)
Stabilizer Bar
260 (19, 25)
130 (9, 13)
kg·cm (ft·lb, N·m) : Specified torque
◆ Non-reusable part
86827g53

Fig. 66 Exploded view of the A44D transmission and components to be removed

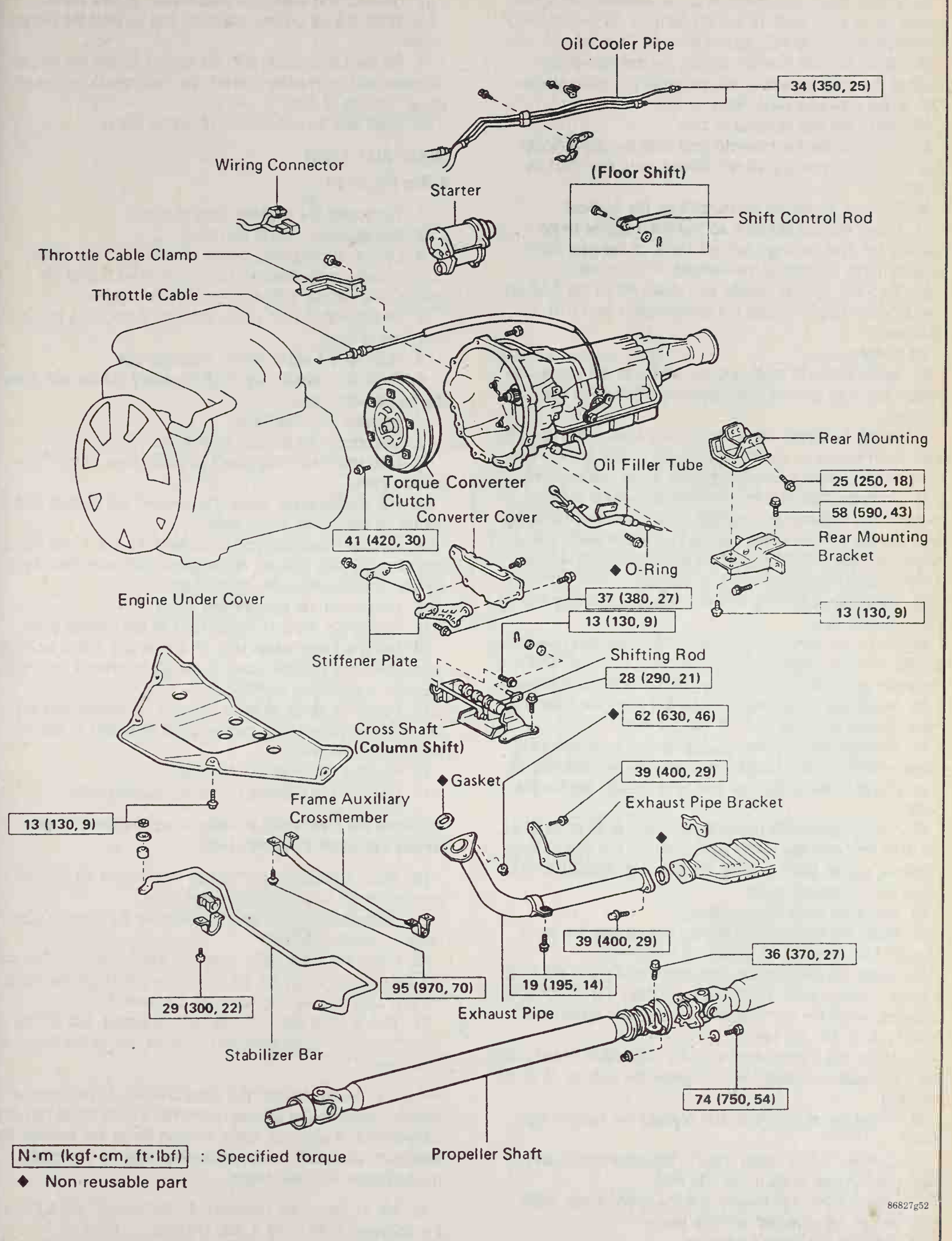

Oil Cooler Pipe
34 (350, 25)
Wiring Connector
Starter
(Floor Shift)
Shift Control Rod
Throttle Cable Clamp
Throttle Cable
Rear Mounting
Oil Filler Tube
25 (250, 18)
58 (590, 43)
Torque Converter
Clutch
Converter Cover
Rear Mounting
Bracket
41 (420, 30)
◆ O-Ring
Engine Under Cover
37 (380, 27)
13 (130, 9)
13 (130, 9)
Stiffener Plate
Shifting Rod
28 (290, 21)
◆ 62 (630, 46)
Cross Shaft
(Column Shift)
◆ Gasket
39 (400, 29)
Frame Auxiliary
Crossmember
Exhaust Pipe Bracket
13 (130, 9)
◆
39 (400, 29)
36 (370, 27)
95 (970, 70)
19 (195, 14)
29 (300, 22)
Exhaust Pipe
Stabilizer Bar
74 (750, 54)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non reusable part
Propeller Shaft
86827g52

Fig. 67 Exploded view of the A340E transmission and components to be removed

28. Mount the torque converter on the flywheel and tighten the converter bolts to 20 ft. lbs. (27 Nm) for A43D and A44D transmissions. For A340E, tighten them to 30 ft. lbs. (41 Nm).

29. Mount the dial indicator so that the indicator probe touches the outer surface of the converter extension sleeve (90° to the converter centerline).

30. Adjust the dial indicator to zero.

31. Slowly rotate the converter and read the dial indicator. The indicator needle should not deviate more than 0.01 in. (0.30mm).

32. Remove the torque converter from the flywheel.

33. Mount the dial indicator so that the indicator probe touches the flywheel ring gear just inside of the gear teeth (surface faces the rear of the vehicle).

34. Zero the indicator needle and slowly rotate the flywheel. The indicator needle should not deviate more than 0.01 in. (0.20mm).

To install:

35. Apply a coat of multi-purpose grease to the torque converter stub shaft and the corresponding pilot hole in the flywheel.

36. Install the torque converter into the front of the transmission. Push inward on the torque converter while rotating it to completely couple the torque converter to the transmission.

37. To make sure that the converter is properly installed, measure the distance between the torque converter mounting lugs and the front mounting face of the transmission. The proper distance is 0.79 in. (20mm) for A43D and A44D; for A340E, correct distance is 0.71 in. (18mm).

38. Install the guide pins into two opposite mounting lugs of the torque converter.

39. Raise the transmission to the engine and align the transmission with the engine alignment dowels. Also, position the converter guide pins into the mounting holes of the flywheel.

40. Install and tighten the transmission-to-engine mounting bolts. Tighten the bolts to 47 ft. lbs. (64 Nm).

41. Remove the converter guide pins and install the converter mounting bolts. Rotate the crankshaft as necessary to gain access to the guide pins and bolts through the service holes.

42. Evenly tighten the converter mounting bolts to 20 ft. lbs. (27 Nm) for A43D and A44D transmissions. For A340E transmissions, tighten them to 30 ft. lbs. (41 Nm). Install the rubber plugs into the access holes.

43. Install the engine undercover.

44. Raise the transmission slightly and remove the wood block(s) from beneath the engine oil pan.

45. Install the transmission crossmember. Tighten the crossmember-to-frame bolts to 70 ft. lbs. (95 Nm). For A43D transmissions, install the rear mounting bracket and tighten the bolts to 43 ft. lbs. (58 Nm).

46. Lower the transmission onto the crossmember and install the transmission mounting bolts. Tighten the bolts to 18 ft. lbs. (25 Nm).

47. Install the oil filler tube and connect the exhaust pipe clamp.

48. Connect the oil cooler lines to the transmission and tighten the fittings to 23 ft. lbs. (31 Nm).

49. Connect the shift linkage and the speedometer cable.

50. Install the driveshaft and the starter.

51. Connect the wiring harnesses.

52. Connect and adjust the transmission throttle cable.

53. Install the air cleaner assembly and connect the battery cables.

54. Fill the transmission with the correct fluid. If the torque converter was completely drained, the transmission will need about 7 quarts of fluid.

55. Road test the vehicle and check for leaks.

A340F AND A340H

▶ See Figure 68

1. Disconnect the negative battery cable.

2. Unplug the air intake connector.

3. Loosen the adjusting nuts and disconnect the throttle cable housing at the bracket. Disconnect the cable at the linkage, then unplug it from the rear of the engine.

4. Underneath the air intake chamber there are 5 connectors; unplug them.

5. Remove the upper starter mounting bolt.

6. Raise the vehicle, support it on safety stands and drain the transmission fluid.

7. Remove the driveshafts.

8. Disconnect the exhaust pipe at the tail pipe.

9. Disconnect and plug the 2 oil cooler lines at the transmission case.

10. Pull out the cotter pin and disconnect the manual shift linkage at the neutral safety switch.

11. Pull the cotter pins and disconnect the No. 1 and No. 2 transfer case shift linkages at the cross shaft over the transmission case. Remove the cross shaft.

12. Disconnect the speedometer cable.

13. Disconnect the 2 oil cooler lines at the transfer case.

14. Using a transmission jack, or a floor jack and a block of wood, raise the transmission just enough to remove pressure from the rear support member.

15. Position a piece of wood between the firewall and the rear of the cylinder head, remove the 8 bolts and lift out the rear support member.

16. Remove the engine under cover.

17. Remove the 6 torque converter mounting bolts.

➡Rotate the crankshaft in order to gain access to the torque converter mounting bolts.

18. Insert a guide pin (just cut off the head of an old bolt) into one of the torque converter bolt holes.

19. Remove the starter and then remove the transmission housing mounting bolts.

20. Using the guide pin to keep the transmission and torque converter together, pry on the end of the pin to get the transmission assembly moving rearward. Be careful!

21. With a large drip pan under the assembly, pull off the converter. Remove the filler tube from the side of the transmission case.

➡Prior to installation of the transmission, Toyota recommends checking the torque converter and flywheel run-out dimensions. If either of these run-out limits are beyond the maximum allowable limits, excessive wear of the front transmission seal will occur.

22. Mount the torque converter on the flywheel and tighten the converter bolts to 30 ft. lbs. (40 Nm).

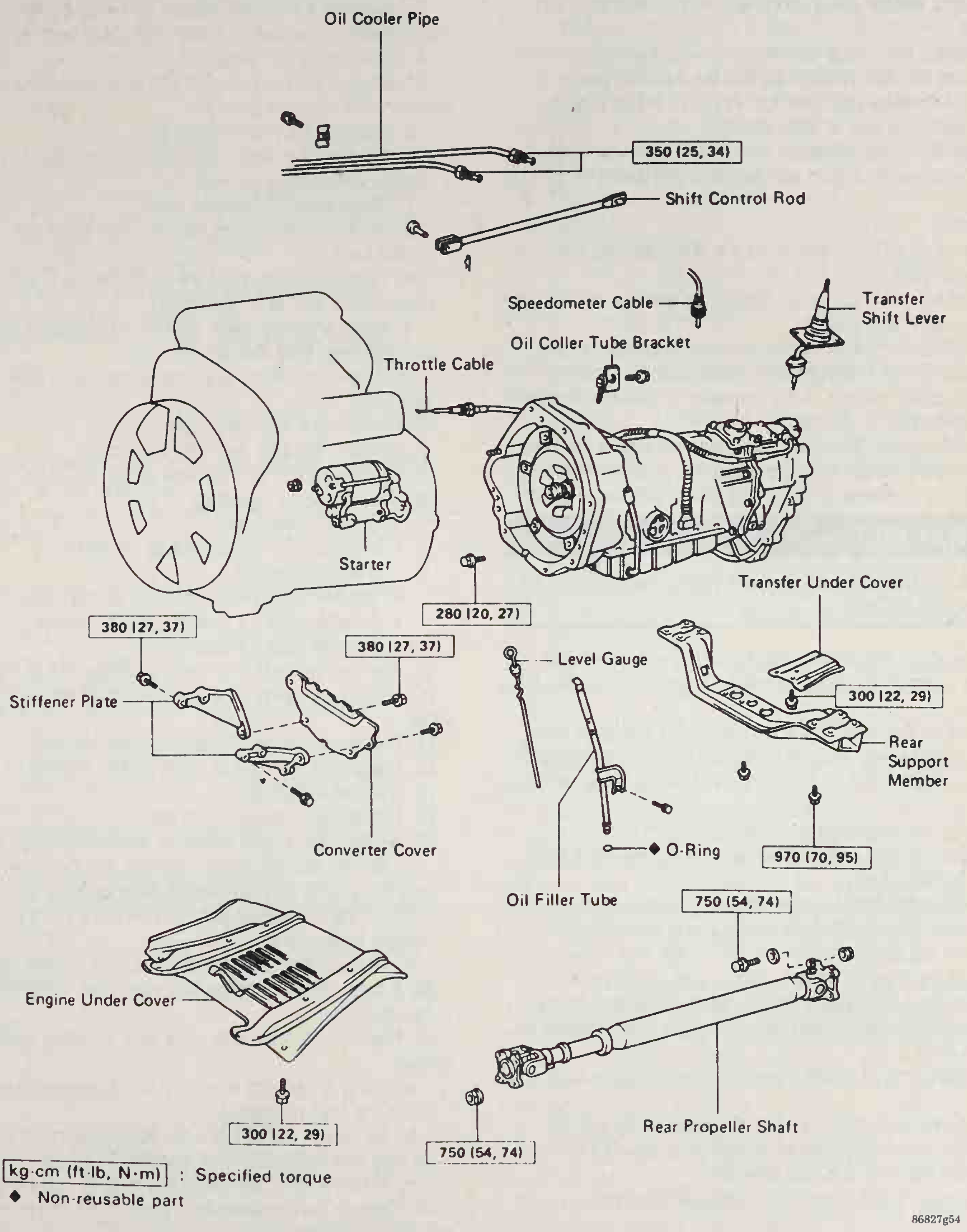

Oil Cooler Pipe
350 (25, 34)
Shift Control Rod
Speedometer Cable
Transfer Shift Lever
Oil Coller Tube Bracket
Throttle Cable
Starter
280 (20, 27)
Transfer Under Cover
380 (27, 37)
380 (27, 37)
Level Gauge
Stiffener Plate
300 (22, 29)
Rear Support Member
Converter Cover
◆ O-Ring
970 (70, 95)
Oil Filler Tube
750 (54, 74)
Engine Under Cover
300 (22, 29)
750 (54, 74)
Rear Propeller Shaft
kg·cm (ft·lb, N·m) : Specified torque
◆ Non-reusable part
86827g54

Fig. 68 Exploded view of the A340F transmission and components to be removed

23. Mount the dial indicator so that the indicator probe touches the outer surface of the converter extension sleeve (90° to the converter centerline).
24. Adjust the dial indicator to zero.
25. Slowly rotate the converter and read the dial indicator. The indicator needle should not deviate more than 0.01 in. (0.30mm).
26. Remove the torque converter from the flywheel.
27. Mount the dial indicator so that the indicator probe touches the flywheel ring gear just inside of the gear teeth (surface faces the rear of the vehicle).
28. Zero the indicator needle and slowly rotate the flywheel. The indicator needle should not deviate more than 0.01 in. (0.20mm).

To install:

29. Use a new O-ring and press the filler tube into the transmission case.
30. Coat the pilot hole in the crankshaft and the center hub of the converter with grease.
31. Install the torque converter into the transmission case. Using calipers and a straightedge, make sure the distance from the installed surface of the converter to the transmission housing lip is 1.02 in. (26mm).
32. Install a guide pin in the converter and align it with one of the driveplate holes. Align the 2 sleeves on the cylinder block with the converter housing and temporarily install a bolt.

✲✲WARNING

Never tilt the transmission forward during installation; the converter will fall out.

33. If all holes are aligned, install the starter and then all remaining transmission housing bolts. Tighten to 47 ft. lbs. (64 Nm).
34. Remove the guide pin and install the 6 converter bolts. Tighten the bolts evenly to 20 ft. lbs. (27 Nm) on models with 4 cylinder engines and to 30 ft. lbs. (41 Nm) on those with the V6.
35. Install the engine under cover.
36. Install the rear support member and tighten the 8 bolts to 70 ft. lbs. (95 Nm).
37. Connect the transfer case oil cooler lines.
38. Connect the speedometer cable being sure that the washer and felt dust protector are still on the end.
39. Connect the shift linkage using a new cotter pin.
40. Coat the cross shaft joint with grease and then install the shaft to the body. Connect the 2 transfer case linkages to the cross shaft.
41. Connect the oil cooler lines to the transmission case and install the bracket.
42. Connect the exhaust pipe to the tailpipe. Tighten the connecting nuts and pipe clamp bolt to 32 ft. lbs. (43 Nm).
43. Install the front and rear driveshafts.
44. Engage the five connectors under the air intake chamber.
45. Install the upper starter mounting nut.
46. Connect and adjust the throttle cable.
47. Connect the air intake connector and the negative battery cable. Fill the transmission with fluid and road test the truck. Check for any leaks.

Tacoma

A340E AND A340F

1. Remove the fluid level dipstick.
2. Remove the engine under cover.
3. Disconnect the throttle cable by loosening the nut then disconnecting the cable. Separate the cable from the clamp.
4. Remove the fan shroud.
5. Remove the transmission shift lever assembly and transfer case shift lever as follows:
   a. Remove the rear console box.
   b. Remove the screws and the front console box with the transfer case shift lever knob.
   c. Disconnect the harness wires.
   d. Remove the nut and washer, then disconnect the shift control knob.
   e. Unattach the harness then remove the 8 screws and transmission shift lever assembly.
   f. Using snapring pliers, remove the snapring and pull out the shift lever from the transfer case.
   g. When reinstalling, apply multi-purpose grease to the shift lever.
6. Remove the fluid level pipe.
7. Remove the front and rear driveshafts.
8. Disconnect the front exhaust pipe.
9. Disconnect the following:
   - Speedometer cable
   - No. 2 vehicle speed sensor harness
   - Solenoid harness
   - Transfer case neutral position switch harness
   - Transfer case L4 position switch harness
   - Transfer case indicator switch
10. Remove the bolts and clamps holding the oil cooler pipe.
11. Loosen the union nuts and disconnect the oil cooler pipes.
12. Disconnect the temperature sensor harness.
13. Disconnect the neutral safety switch harness.
14. Remove the starter.
15. Unbolt the stabilizer bar bracket.
16. Remove the torque converter clutch mounting bolt:
   a. On the 3RZ-FE engine, remove the 2 nuts and bolts, then the 2 bolts and flywheel housing under cover.
   b. On the 5VZ-FE engine remove the 4 bolts and flywheel housing under cover.
   c. While turning the crankshaft to gain access, remove the 6 bolts. When installing first attach the green colored bolt then the other 5.
17. Remove the front differential rear mounting cushion as follows:
   a. Using a hexagon wrench (12mm), remove the nut. then lift up the front differential.
   b. Be careful not to touch the torque converter clutch housing and front differential companion flange.
   c. Remove the 2 rear mounting cushion mounting bolts.
18. Remove the crossmember, support the transmission rear side with a suitable jack.
19. Remove the mounting bolts then the crossmember. Be sure to support the transmission with a jack.
20. Lower the transmission rear side.
21. Separate the wire harness from the transmission.

22. On the 3RZ-FE engine remove the 4 bolts and transmission. On the 5VZ-FE engine, remove the 6 bolts and transmission.
23. To install reverse the procedure. Always use new gaskets and O-rings.
24. Fill the unit with the correct fluid, start the vehicle and test the operation.

T100

A340E AND A340F

1. Remove the fluid level dipstick.
2. Unbolt the engine under cover.
3. Disconnect the throttle cable by loosening the nut then disconnecting the cable. Separate the cable from the clamp.
4. Raise and safely support the vehicle.
5. Remove the fluid level dipstick.
6. Remove the front and rear driveshafts.
7. Disconnect the front exhaust pipe.
8. Disconnect the speedometer cable and vehicle speed sensor harness.
9. Remove the cross shaft as follows:
    a. Remove the clip and disconnect the No. 2 gear shifting rod.
    b. Remove the nut, washer, 4 bolts and the cross shaft.
10. Remove the oil cooler pipe.
11. Remove the bolts and clamps holding the oil cooler pipe.
12. Loosen the union nuts and disconnect the oil cooler pipes.
13. Disconnect the transmission fluid temperature sensor harness.
14. Disconnect the neutral safety switch harness.
15. Disconnect the starter wire.
16. Remove the stabilizer bar.
17. Remove the rear end plate nuts, bolts and plate.
18. Disconnect the rear mounting insulator.
19. Jack up the transmission.
20. While turning the crankshaft to gain access to the 6 bolts, remove them.
21. Disconnect the harness and connectors from the transmission.
22. Unbolt the transmission from the engine.
23. To install reverse the procedure. Always use new gaskets and O-rings.
24. Fill the unit with the correct fluid, start the vehicle and test the operation.

Land Cruiser

A440F

➧ See Figures 69 and 70

1. Disconnect the negative battery cable.
2. Remove the battery and the battery cover.
3. Loosen the cooling fan shroud bolts. This will avoid fan damage.
4. Loosen the adjusting nuts for the throttle control cable. Disconnect the cable housing from the bracket; disconnect the cable from the throttle linkage.
5. Unplug the electrical connectors near the starter.
6. Remove the transfer case shift lever as follows:
    a. Under the vehicle, remove the nut and transmission control rod.
    b. Remove the transfer case shift lever knob.
    c. Remove the four screws holding the console and remove the console.
    d. Remove the four bolts and remove the transfer case shift lever boot.
    e. Remove the three bolts holding the console box.
    f. Remove the six bolts holding the transmission shift lever assembly. Remove the assembly.
    g. Pull out the pin and disconnect the shift rod.
    h. Remove the four bolts holding the transfer case shift lever and remove the lever assembly.
7. Elevate and safely support the vehicle. Double check the supports for placement and security.
8. Disconnect the speedometer cable.
9. Remove the front and rear propeller shafts.
10. Remove the starter.
11. Remove the two line clamps and disconnect the oil cooler lines at the transmission.
12. Remove the undercover.
13. Remove the endplate hole plug. Turn the crankshaft to gain access to each of the six torque converter mounting bolts. Remove the bolts.
14. Support the transmission, either with a transmission jack (preferred) or a floor jack and a broad piece of wood to protect the transmission. Tension the jack just enough to take tension off the crossmember.
15. Remove the bolts and nuts holding the crossmember and remove it.
16. Use a floor jack and a piece of wood to support the engine under the oil pan. Do NOT bend the oil pan.
17. Lower the rear end of the transmission and slide the unit away from the engine.
18. With the transmission removed, set up a dial indicator and measure the driveplate run-out. If run-out exceeds 0.0079 in. (0.20mm) or if the ring gear is damaged, the driveplate must be replaced.
19. Temporarily mount the torque converter to the driveplate. Set up a dial indicator and measure run-out at the center of the torque converter. If run-out exceeds 0.0118 in. (0.30mm), try to correct it by repositioning the torque converter. If the repositioning corrects the error, make matchmarks so that the position is used at reinstallation. If the misalignment cannot be corrected, the torque converter must be replaced. Remove the torque converter when measurement is completed.

To install:

20. With the torque converter installed on the transmission, check the converter installation with a straightedge across the front of the case. Correct distance from the surface of the bolt lugs to the front of the case is 0.618 in. (1.57mm) or more. If the distance measured is less than specified, check the converter for improper installation.
21. Elevate the transmission and push it fully into place. Install the transmission retaining bolts and tighten them to 53 ft. lbs. (72 Nm).
22. Install the rear mount to the transmission. Tighten the retaining bolts to 43 ft. lbs. (59 Nm).
23. Install the crossmember. Tighten the bolts to 45 ft. lbs. (61 Nm) and the nuts to 43 ft. lbs. (59 Nm).
24. Install the torque converter mounting bolts, tightening them to 21 ft. lbs. (28 Nm). Install the end plate hole plug when finished.
25. Install the undercover.

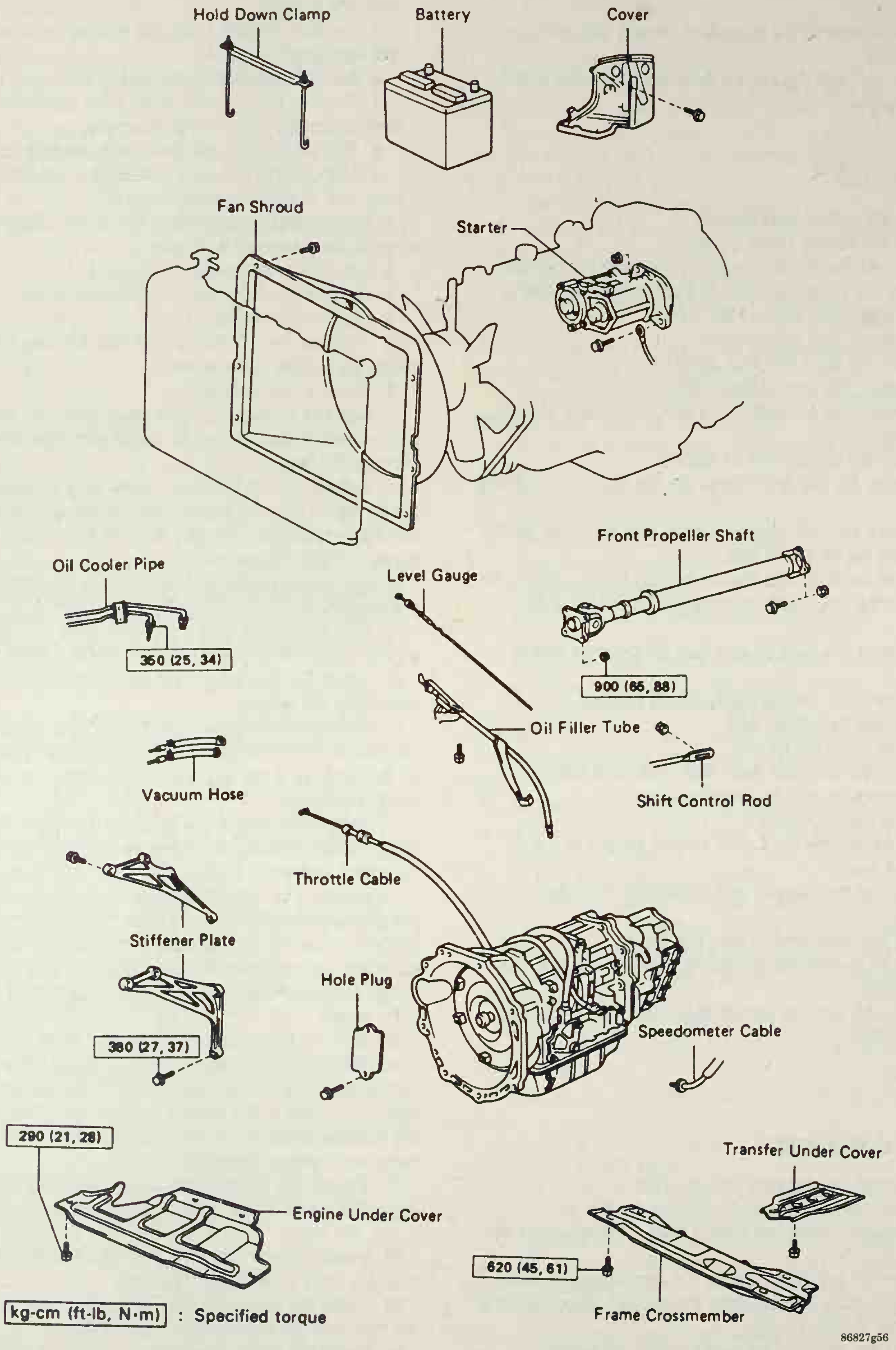

Hold Down Clamp
Battery
Cover
Fan Shroud
Starter
Front Propeller Shaft
Oil Cooler Pipe
Level Gauge
350 (25, 34)
900 (65, 88)
Oil Filler Tube
Vacuum Hose
Shift Control Rod
Throttle Cable
Stiffener Plate
Hole Plug
Speedometer Cable
380 (27, 37)
290 (21, 28)
Transfer Under Cover
Engine Under Cover
620 (45, 61)
kg-cm (ft-lb, N·m) : Specified torque
Frame Crossmember
86827g56

Fig. 69 Exploded view of the A440F transmission and components to be removed

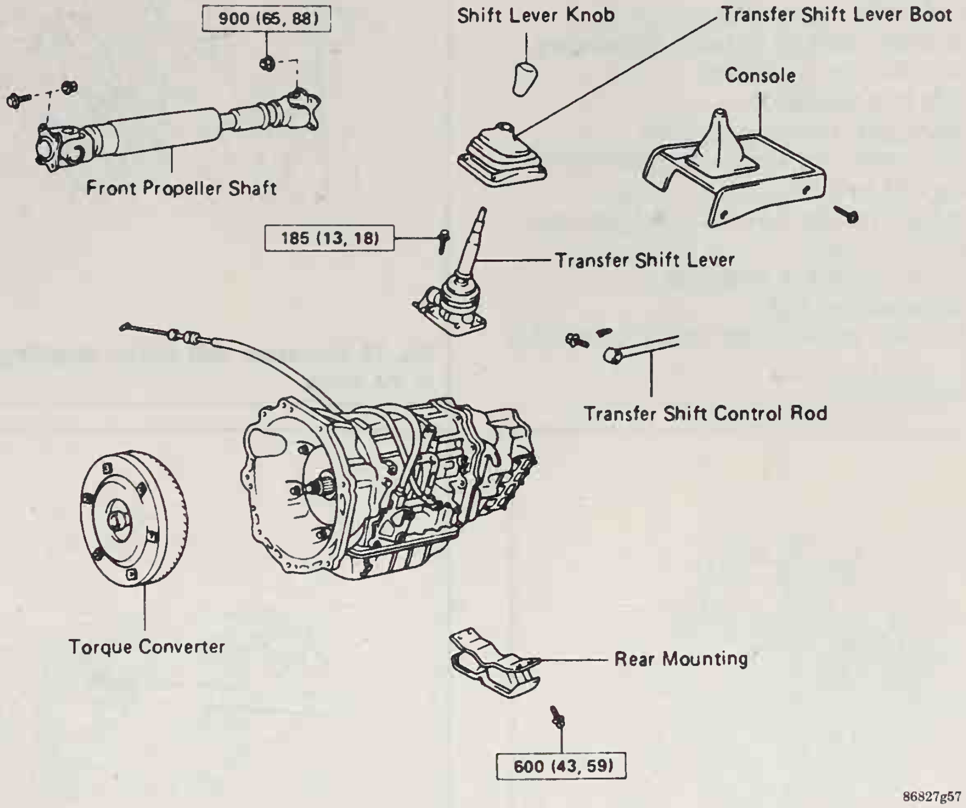

900 (65, 88)
Shift Lever Knob
Transfer Shift Lever Boot
Console
Front Propeller Shaft
185 (13, 18)
Transfer Shift Lever
Transfer Shift Control Rod
Torque Converter
Rear Mounting
600 (43, 59)
86827g57

Fig. 70 Exploded view of the A440F transmission and components to be removed (continued)

26. Connect the oil cooler lines, tightening the fittings to 25 ft. lbs. (34 Nm). Install the cooler line clamps.
27. Install the front and rear driveshafts.
28. Install the oil filler tube.
29. Install the starter.
30. Connect the speedometer cable.
31. The transfer case shift lever is installed by reversing the removal sequence. The four shift lever bolts should be tightened to 13 ft. lbs. (18 Nm). The six bolts holding the transmission shift lever should be tightened only to 48 inch lbs. (5 Nm).
32. Engage the electrical connectors near the starter.
33. Connect and adjust the throttle cable.
34. Tighten the fan shroud bolts.
35. Connect the negative battery cable.
36. Add the correct amount of fluid.

A343F AND A442F

See Figures 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89 and 90

1. Remove the battery and battery tray. Always disconnect the negative battery cable first.
2. Unbolt the fan shroud for the cooling fan.
3. Disconnect the throttle cable by loosening the adjusting nut and removing the cable from the bracket.
4. Detach the cable from the linkage.
5. Remove the upper side starter mounting bolt.
6. Remove the clip, washer and wave washer, then disconnect the transfer case shift lever link.
7. Remove the nut and washer, then disconnect the transmission select lever link.
8. Unscrew the transfer case shift lever knob.
9. Unbolt the console and set aside.
10. Remove the mounting screws for the transfer case shift lever boot.
11. Remove the console box.

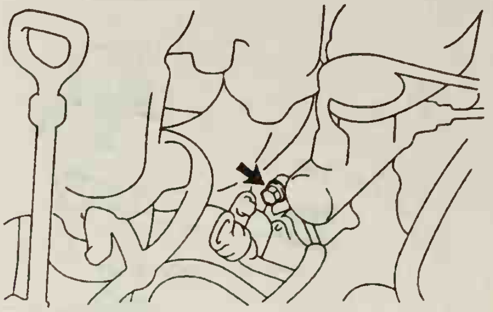


Fig. 73 The upper side starter mounting bolt is located at the arrow

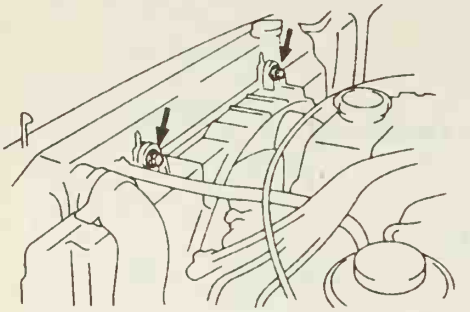


Fig. 71 Unbolt the fan shroud for the cooling fan

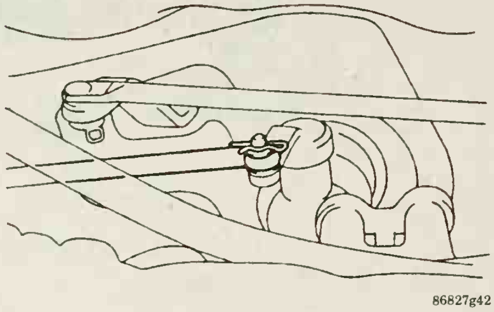


Fig. 74 When removing the select lever and shift lever, always discard the old clip; it should not be reused

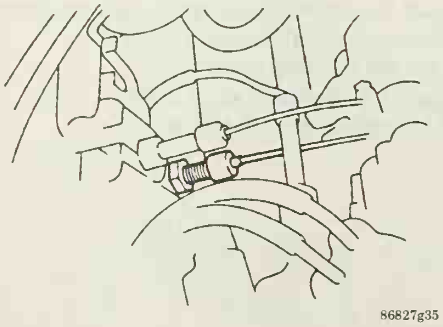


Fig. 72 Disconnect the throttle cable by loosening the adjusting nut

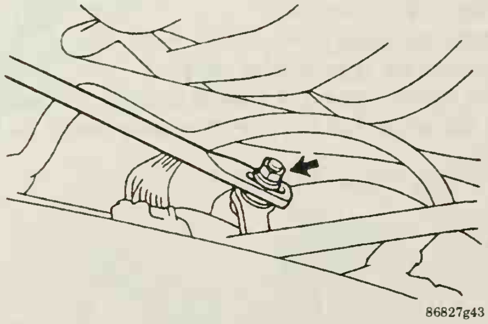


Fig. 75 Use the correct size wrench to remove this nut, as a rounded-off nut is never pleasant

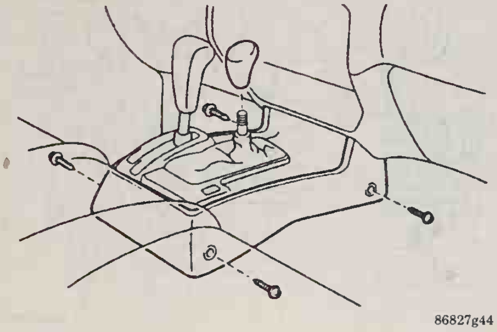


Fig. 76 After removing the shift knob, unscrew the console

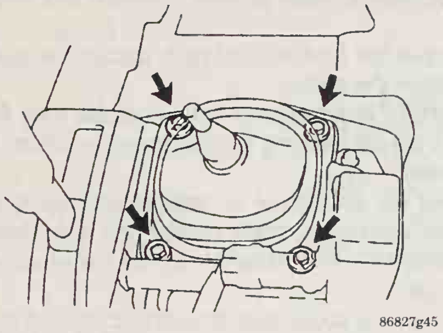


Fig. 77 The shift lever boot has 4 mounting screws

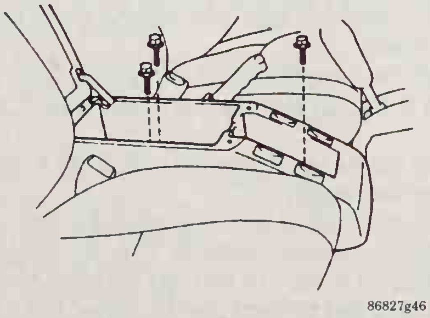


Fig. 78 The other console screws are on the top and deep inside

12. Disconnect the wiring harnesses.
13. Remove the 6 mounting screws for the transmission shift lever assembly.
14. Unbolt the transfer case shift lever, then remove the two cushions.
15. If applicable, disconnect the following:
    - Vehicle speed sensors
    - Neutral safety switch
    - Solenoid connector
    - ATF temperature sensor
    - Center differential lock indicator switch
    - L4 position switch
    - Bleeder hose from the transfer case
16. Remove the front and rear driveshafts.
17. Remove the oil level dipstick.
18. Unbolt the upper side mounting.
19. Remove the bolt retaining the filler pipe. Discard the old O-ring.
20. Loosen the two oil cooler pipe union nuts.
21. Remove the 4 stabilizer bar bracket mounting bolts.

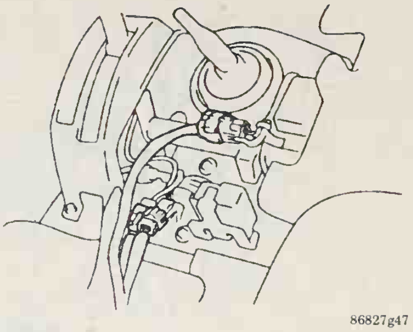


Fig. 79 Disconnect the harnesses, then move them out of the way. If necessary, tag them to simplify reconnection

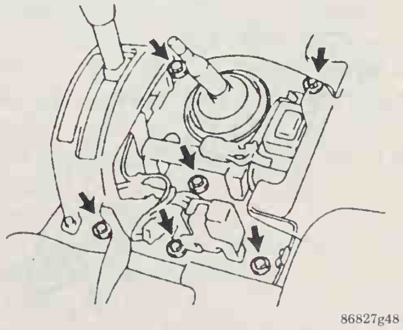


Fig. 80 These six screws surround the shift lever assembly

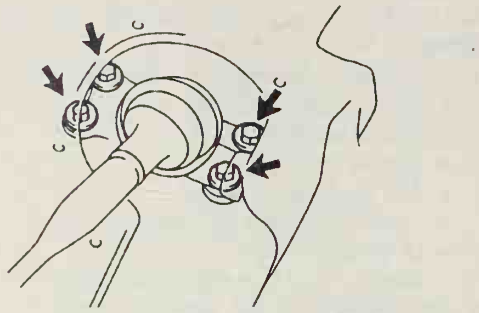


Fig. 81 Once these four bolts are removed, separate the two cushions underneath

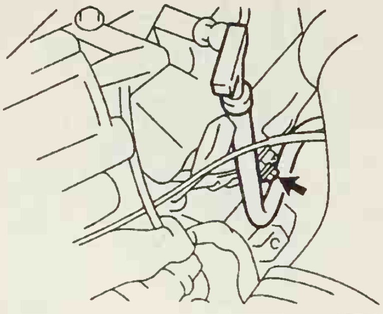


Fig. 82 There is a side mounting bolt for the oil filler tube

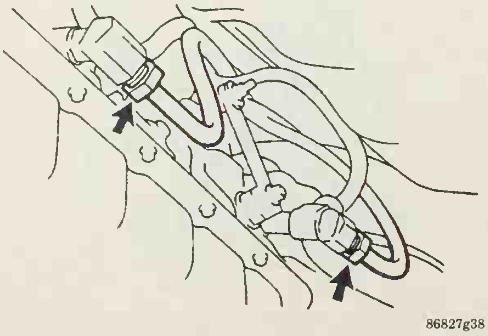


Fig. 83 A pipe wrench may be used to separate the union nuts on the oil cooler line

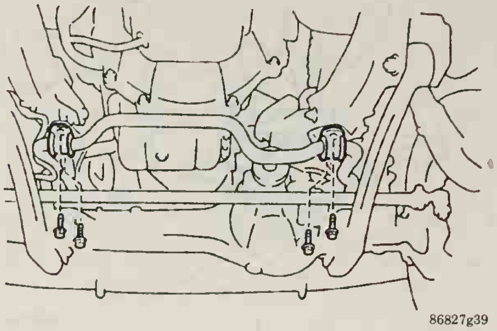


Fig. 84 When removing the stabilizer bar bolts, there are two U-brackets holding the bar into place

22. Separate the engine undercover from the vehicle.
23. Take the converter plug off.
24. Turn the crankshaft to gain access to each bolt, then hold the crankshaft pulley nut with a wrench and remove the 6 bolts.
25. Remove the front exhaust pipe, discard the gaskets.
26. Remove the starter.
27. Support the transmission with a suitable jack. Remove the bolts and nuts retaining the crossmember. Lower the crossmember.
28. Lower the rear end of the transmission. Be careful not to damage the cooling fan, brake booster and brake line.
29. Separate the wire harness from the transmission and transfer case.
30. Remove the cooler pipe mounting bolts from the torque converter clutch housing, then disconnect the 2 oil cooler pipes from the elbows.
31. Remove the transmission mounting bolts.

To install:

32. Using calipers and a straightedge, measure from the installed surface of the transmission housing. The distance should be more than 0.618 in. (15.7mm). Install the transmission, tighten to 53 ft. lbs. (72 Nm).
33. Attach the oil cooler pipe mounting with the bolts to the converter housing, then attach the harness to the transfer case and transmission.
34. Attach the crossmember to the vehicle. Tighten the 8 bolts to 45 ft. lbs. (61 Nm) and the 2 nuts to 54 ft. lbs. (74 Nm).
35. Install the starter. Tighten the bolts to 29 ft. lbs. (39 Nm). Attach the harness.
36. Using new gaskets and nuts, attach the front exhaust pipe. Tighten the support bracket to 17 ft. lbs. (24 Nm), the clamp bolts to 14 ft. lbs. (19 Nm), the front pipe-to-manifold 46 ft. lbs. (62 Nm), and the front pipe-to-catalytic converter to 29 ft. lbs. (39 Nm).
37. Install the torque converter clutch mounting bolt. Tighten to 40 ft. lbs. (55 Nm). First install the gray colored bolt, then the other 5 bolts.
38. Install the front engine undercover, tighten to 21 ft. lbs. (28 Nm).

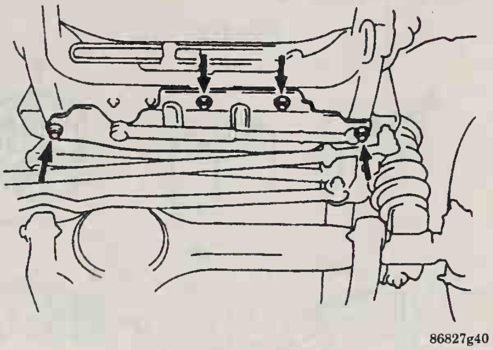


Fig. 85 The engine under cover is located above the center link

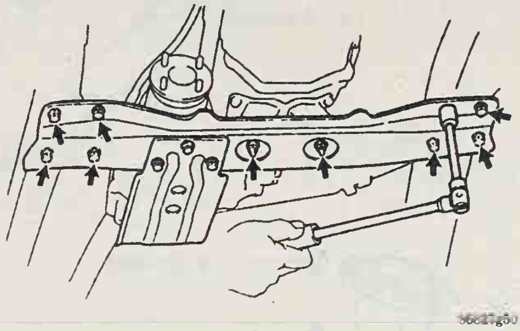


Fig. 86 You will need an extension to remove the bolts on the crossmember

39. Place the 4 stabilizer bar bracket mounting bolts into position, then tighten to 13 ft. lbs. (18 Nm).
40. Attach the 2 oil cooler pipe union nuts.
41. With a new O-ring, install the oil filler pipe. Insert the level dipstick into the pipe.
42. Install the front and rear driveshafts.
43. Install the following:
    - Center differential lock indicator switch
    - L4 position switch
    - Neutral safety switch and connector
    - Bleeder hose from the transfer case
    - Vehicle speed sensors
    - Solenoid connector
    - ATF temperature sensor
44. Place the transfer case shift lever into position. Tighten the 4 bolts to 13 ft. lbs. (18 Nm). Attach the 6 screws, tighten to 48 inch lbs. (5 Nm).
45. Attach the connectors to the shift lever assembly. Install the 3 mounting bolts on the console box. Place the shift lever boot into position, then tighten the 4 screws. Slip the console over the lever assembly and tighten the 4 screws.
46. Screw on the transfer case shifter knob.
47. Place the nut and washer on the select lever linkage.
48. Install the wave washer, washer and new clip onto the shift lever linkage.
49. Attach the upper side starter mounting bolt. Tighten to 29 ft. lbs. (39 Nm).
50. Attach the throttle linkage.
51. Install the fan shroud for the cooling fan.
52. Install the battery tray and battery.
53. Fill the transmission.
54. Start the vehicle. Test the operation of the unit.

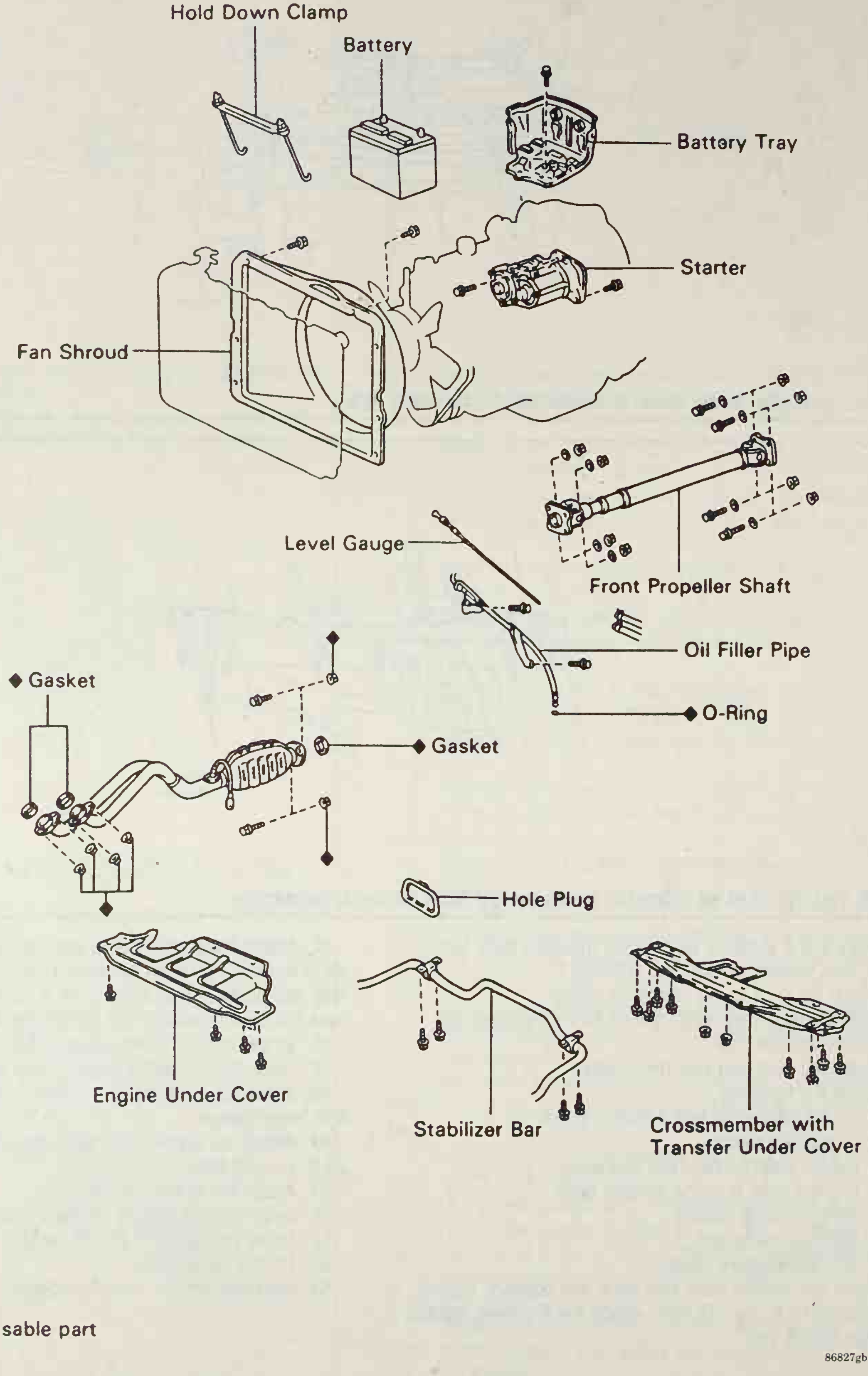

Hold Down Clamp
Battery
Battery Tray
Starter
Fan Shroud
Level Gauge
Front Propeller Shaft
Oil Filler Pipe
◆ O-Ring
◆ Gasket
◆ Gasket
Hole Plug
Engine Under Cover
Stabilizer Bar
Crossmember with Transfer Under Cover
◆ Non-reusable part
86827gb3

Fig. 87 Exploded view of components to be removed — A343F transmission

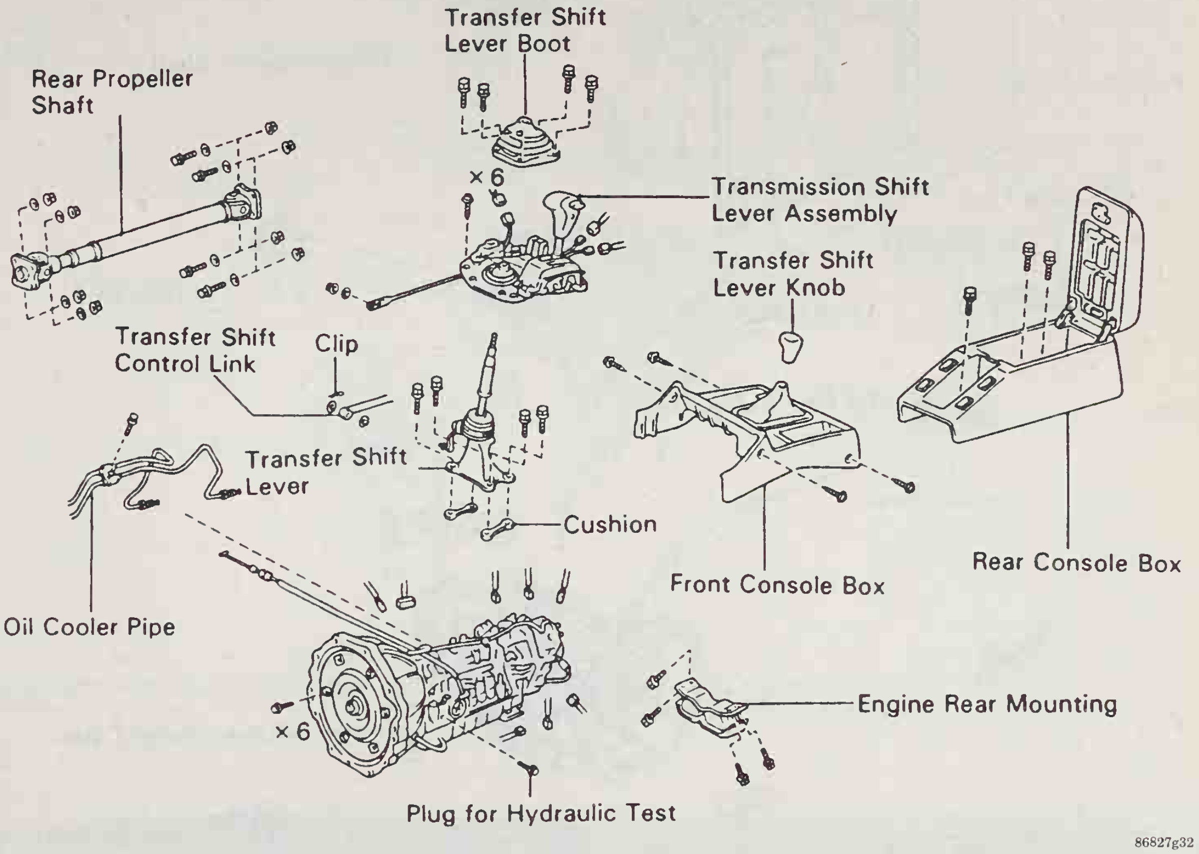

Transfer Shift Lever Boot
Rear Propeller Shaft
× 6
Transmission Shift Lever Assembly
Transfer Shift Lever Knob
Transfer Shift Control Link
Clip
Transfer Shift Lever
Cushion
Oil Cooler Pipe
Front Console Box
Rear Console Box
× 6
Engine Rear Mounting
Plug for Hydraulic Test
86827g32

Fig. 88 Exploded view of the A343F transmission and components to be removed (continued)

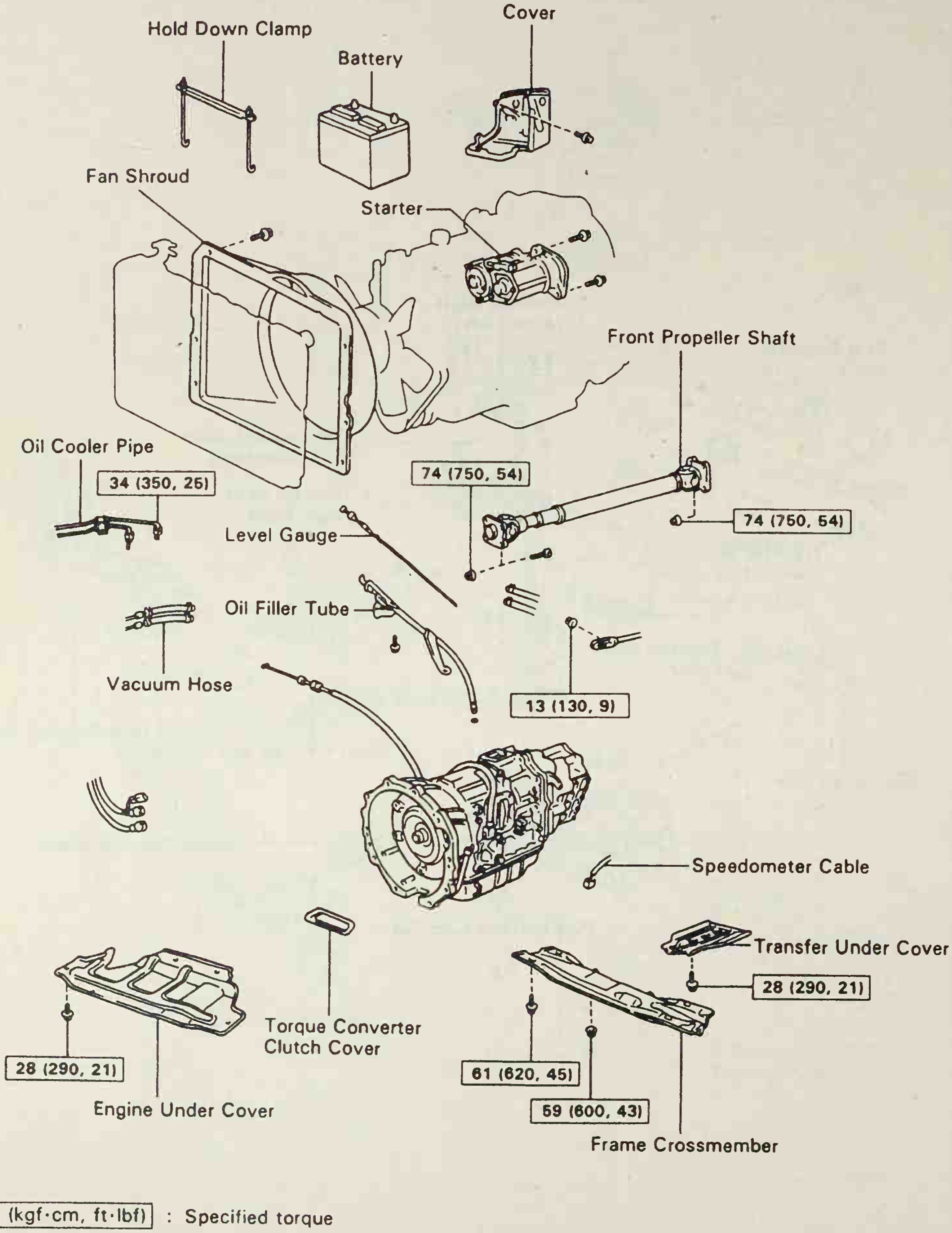

Hold Down Clamp
Battery
Cover
Fan Shroud
Starter
Front Propeller Shaft
Oil Cooler Pipe
34 (350, 25)
74 (750, 54)
74 (750, 54)
Level Gauge
Oil Filler Tube
Vacuum Hose
13 (130, 9)
Speedometer Cable
Transfer Under Cover
28 (290, 21)
Torque Converter Clutch Cover
28 (290, 21)
Engine Under Cover
61 (620, 45)
59 (600, 43)
Frame Crossmember
N·m (kgf·cm, ft·lbf) : Specified torque
86827g30

Fig. 89 Exploded view of components to be removed — A442F transmission

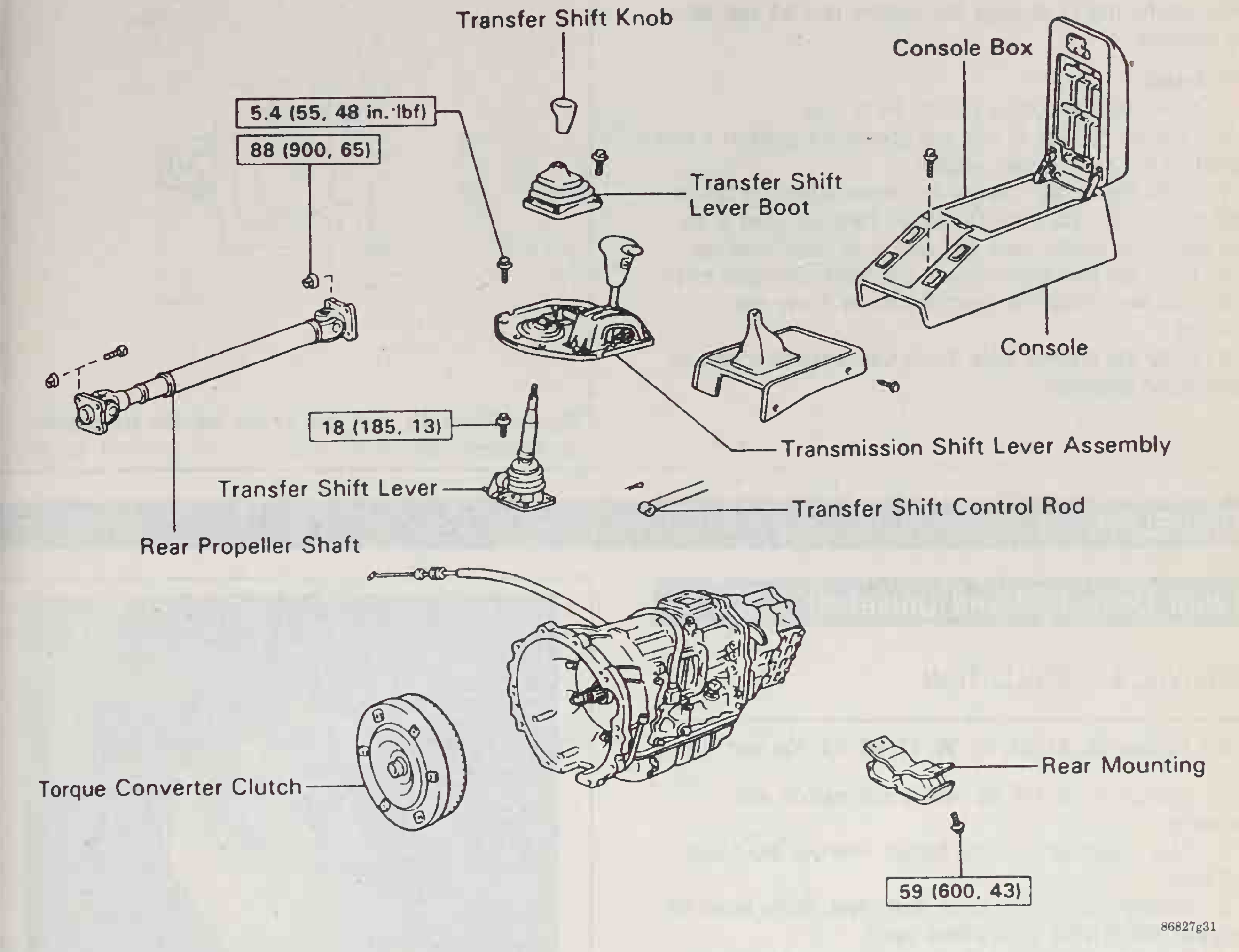

Transfer Shift Knob
Console Box
5.4 (55, 48 in.·lbf)
88 (900, 65)
Transfer Shift Lever Boot
Console
18 (185, 13)
Transmission Shift Lever Assembly
Transfer Shift Lever
Transfer Shift Control Rod
Rear Propeller Shaft
Rear Mounting
Torque Converter Clutch
59 (600, 43)
86827g31

Fig. 90 Exploded view of the A442F transmission and components to be removed (continued)

TRANSFER CASE

Applications

Toyota Pick-Ups, 4Runners, T100's and Tacomas use either the RF1A or VF1A transfer case. The RF1A uses a countergear reduction scheme.

The VF1A transfer case is a planetary gear reduction unit. It is found in the T100, Pick-Up, and 4Runner.

The Land Cruiser employs the HF2A or HF2AV transfer case, used with the A440F and A343F transmissions for full time 4WD application.

Transfer Case Assembly

REMOVAL & INSTALLATION

See Figure 91

➡The transfer case is removed as an assembly with the transmission.

1. Remove the transmission assembly. On some models it will be necessary to remove the breather hose between the transmission control retainer and the transfer case upper cover.
2. Remove the rear engine mount from the case. Remove the dynamic damper if one is present.
3. Remove the upper driveshaft dust cover.

4. Remove the transfer case adapter rear mounting bolts, then pull the transfer case straight up and remove it.

➡Be careful not to damage the adapter rear oil seal during removal.

To install:

5. Move the 2 shift forks into the H4 position.
6. Coat the adapter oil seal with grease and position a new gasket on the transfer case adapter.
7. Install the transfer case to the transmission. Tighten the bolts to 29 ft. lbs. (39 Nm). The longer bolts are used at the dust cover, the shorter ones are used in all other locations.
8. Install the rear engine mount and tighten the bolts to 19 ft. lbs. (25 Nm). Install the dynamic damper if one was removed.
9. Install the breather hose if one was removed. Install the transmission assembly.

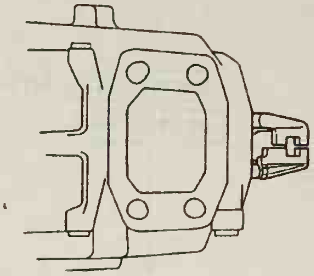


Fig. 91 Place the shift fork shafts into the H4 position as shown

DRIVELINE

Front Driveshaft and Universal Joints

REMOVAL & INSTALLATION

➧ See Figures 92, 93, 94, 95, 96, 97, 98, 99, 100 and 101

1. Jack up the front of the vehicle and support with jackstands.
2. Place matchmarks on the flanges. Remove the 4 nuts and bolts.
3. Remove the front driveshaft dust cover. Some types are equipped with 2 bolts, while others use 4.
4. Remove the driveshaft dust cover subassembly. The three bolts are two different sizes.

➡The driveshaft dust cover is located around the outer portion of the U-joint. On some models you may have an upper and lower.

5. Suspend the front side of the driveshaft.
6. Place matchmarks on the flanges. Remove the 4 nuts and bolts.
7. Remove the front driveshaft.

To install:

8. Align the matchmarks on the rear flanges, then connect the flanges with the nuts and/or bolts. Tighten to 54 ft. lbs. (74 Nm).
9. Install the front driveshaft dust cover subassembly. Tighten bolts A to 27 ft. lbs. (36 Nm) and B to 17 ft. lbs. (23 Nm).

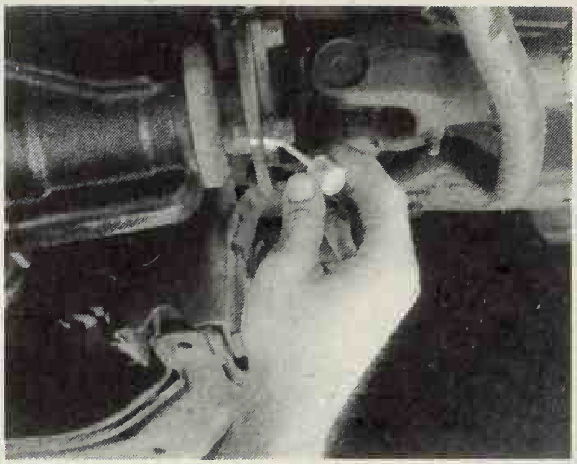


Fig. 92 ALWAYS matchmark with paint prior to separating the driveshaft from the vehicle

10. Align the matchmarks on the front flanges, then connect the flanges with the bolts and nuts. Tighten to 54 ft. lbs. (74 Nm).
11. Install the front driveshaft dust cover. Tighten the bolts to 13 ft. lbs. (17 Nm) and the nuts to 10 ft. lbs. (13 Nm).
12. Attach the rear driveshaft flange to the companion flange on the transfer case. Align the matchmarks on the flanges, then connect the flanges with the bolts and nuts. Tighten to 54-56 ft. lbs. (74-76 Nm).
13. Lower the vehicle and road test it.

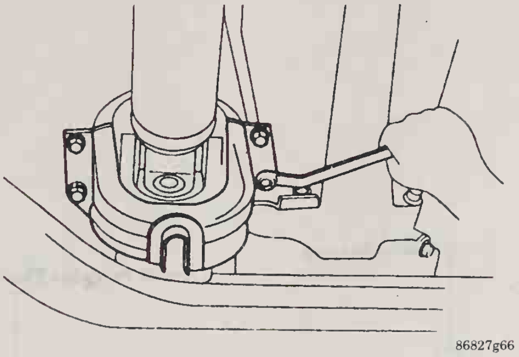


Fig. 93 Remove the front dust cover retaining bolts

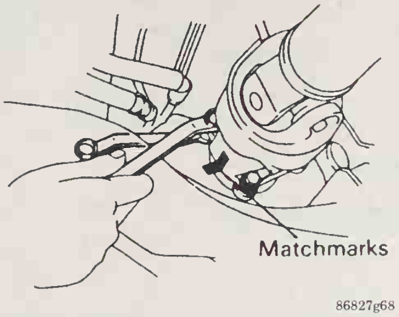

Matchmarks
86827g68

Fig. 94 The matchmarks on the flanges are helpful in installation for lining things up correctly

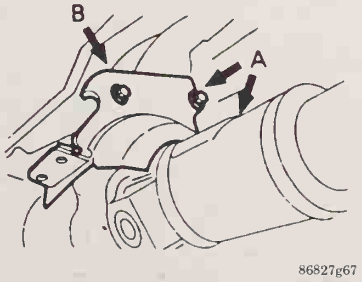

B
A
86827g67

Fig. 95 Tighten bolt A to 27 ft. lbs. (36 Nm) and B to 17 ft. lbs. (23 Nm)

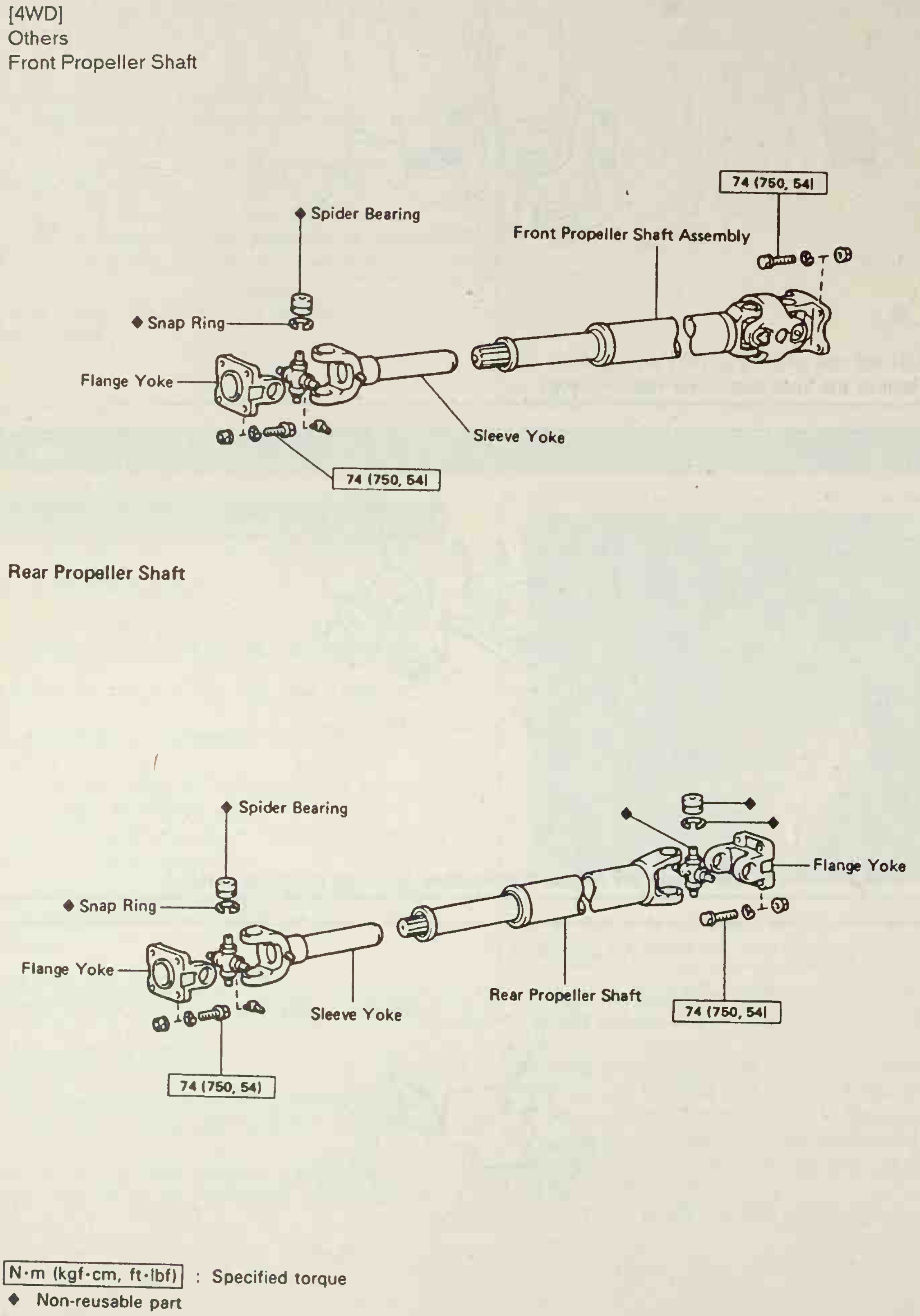

[4WD]
Others
Front Propeller Shaft
74 (750, 54)
◆ Spider Bearing
Front Propeller Shaft Assembly
◆ Snap Ring
Flange Yoke
Sleeve Yoke
74 (750, 54)
Rear Propeller Shaft
◆ Spider Bearing
◆ Snap Ring
Flange Yoke
Flange Yoke
Sleeve Yoke
Rear Propeller Shaft
74 (750, 54)
74 (750, 54)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g71

Fig. 96 Exploded view of the front driveshaft — 1989-95 4WD Pick-Up and 4Runner except with 3VZ-FE engine

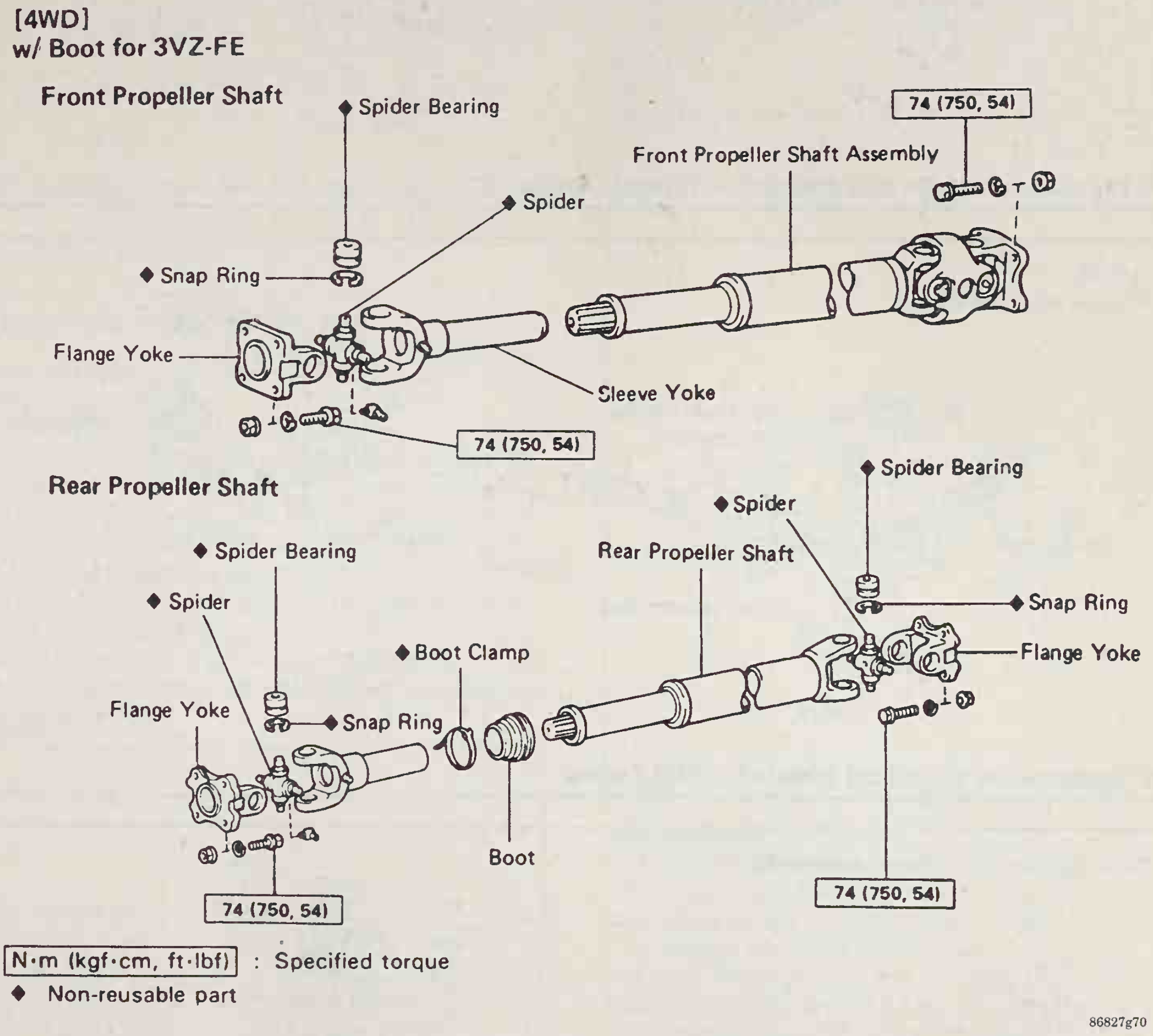

[4WD]
w/ Boot for 3VZ-FE
Front Propeller Shaft
◆ Spider Bearing
74 (750, 54)
Front Propeller Shaft Assembly
◆ Spider
◆ Snap Ring
Flange Yoke
Sleeve Yoke
74 (750, 54)
Rear Propeller Shaft
◆ Spider Bearing
◆ Spider
Rear Propeller Shaft
◆ Spider Bearing
◆ Spider
◆ Snap Ring
◆ Boot Clamp
Flange Yoke
Flange Yoke
◆ Snap Ring
Boot
74 (750, 54)
74 (750, 54)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g70

Fig. 97 Exploded view of the front driveshaft — 1989-95 4WD Pick-Up and 4Runner with 3VZ-FE engine

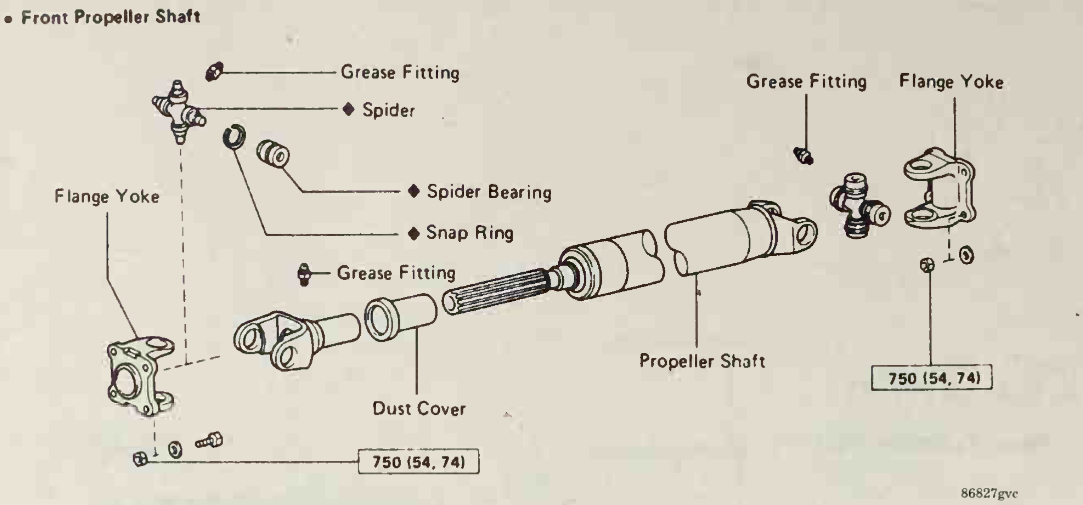

• Front Propeller Shaft
Grease Fitting
◆ Spider
◆ Spider Bearing
◆ Snap Ring
Flange Yoke
Grease Fitting
Dust Cover
750 (54, 74)
Grease Fitting
Flange Yoke
Propeller Shaft
750 (54, 74)
86827gvc

Fig. 98 Exploded view of the front driveshaft — 4WD Land Cruiser

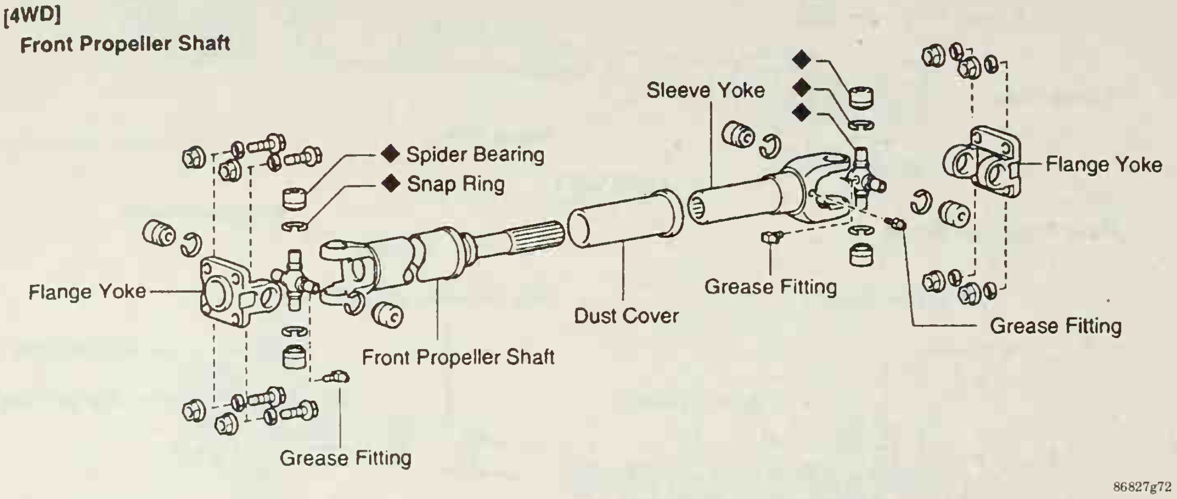

[4WD]
Front Propeller Shaft
◆ Spider Bearing
◆ Snap Ring
Flange Yoke
Front Propeller Shaft
Grease Fitting
Dust Cover
Sleeve Yoke
◆
◆
◆
Grease Fitting
Flange Yoke
Grease Fitting
86827g72

Fig. 99 Exploded view of the front driveshaft — 4WD Tacoma

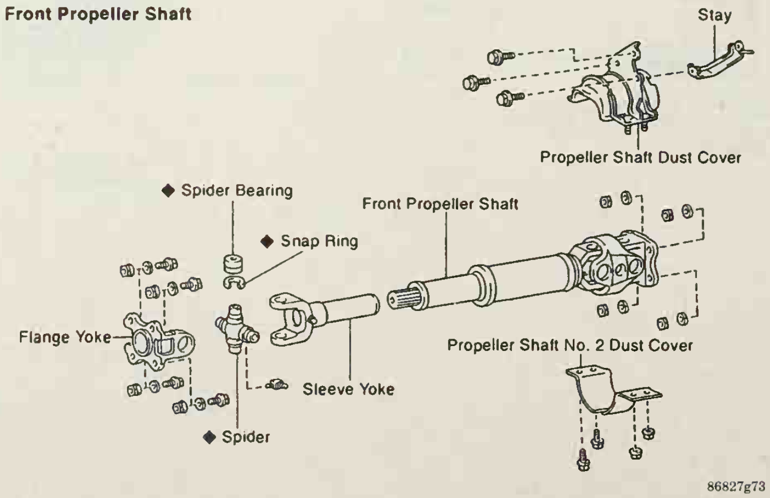

Front Propeller Shaft
Stay
Propeller Shaft Dust Cover
◆ Spider Bearing
◆ Snap Ring
Front Propeller Shaft
Flange Yoke
Sleeve Yoke
◆ Spider
Propeller Shaft No. 2 Dust Cover
86827g73

Fig. 100 Exploded view of the front driveshaft — 4WD T100

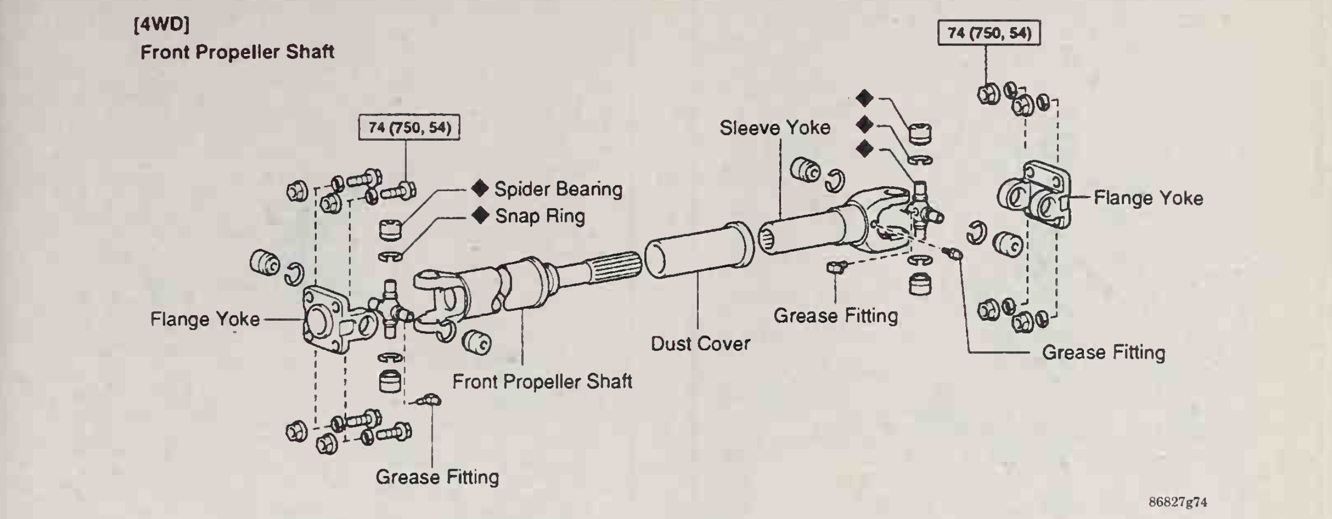

[4WD]
Front Propeller Shaft
74 (750, 54)
◆ Spider Bearing
◆ Snap Ring
Flange Yoke
Front Propeller Shaft
Grease Fitting
Dust Cover
Sleeve Yoke
74 (750, 54)
◆
◆
◆
Flange Yoke
Grease Fitting
Grease Fitting
86827g74

Fig. 101 Exploded view of the front driveshaft — 1996 4WD 4Runner

U-JOINT REPLACEMENT

➧ See Figures 102, 103, 104, 105 and 106

1. Raise and support the vehicle.
2. Remove the driveshaft.
3. Matchmark the yoke and the driveshaft.
4. Remove the snaprings from the bearings. There are two types of snaprings; Toyota and Dana.
5. Position the yoke on vise jaws. Using a bearing remover and a hammer, gently tap the remover until the bearing is driven out of the yoke about 1 in. (25mm).
6. Place the tool in the vise and drive the yoke away from the tool until the bearing is removed.
7. Repeat Steps 4 and 5 for the other bearings.
8. Check for worn or damaged parts. Inspect the bearing journal surfaces for wear.

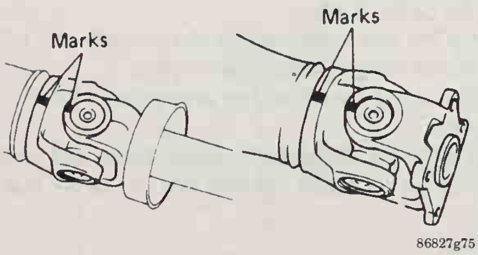

Marks
Marks
86827g75

Fig. 102 Always place matchmarks on the spider and yoke

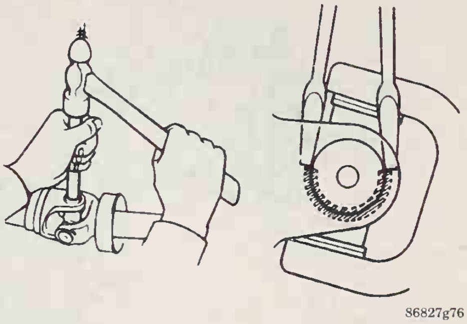


Fig. 103 Tap out the Toyota type snaprings

To assemble:

9. Install the bearing cups, seals, and O-rings in the spider.
10. Apply multi-purpose grease to a new spider and bearings. Be careful not to apply too much grease.
11. Position the spider into the yoke.
12. Start the bearings in the yoke, then press them into place, using a vise. Repeat for the other bearings.
13. If the axial play of the spider is greater than 0.0020 in. (0.05mm), select snaprings which will provide the correct play. Be sure that the snaprings are the same size on both sides or driveshaft noise and vibration will result.
14. Check the U-joint assembly for smooth operation.

➡When replacing the driveshaft U-joints on a 4WD vehicle, be sure that the grease fitting is accessible after the joint is assembled.

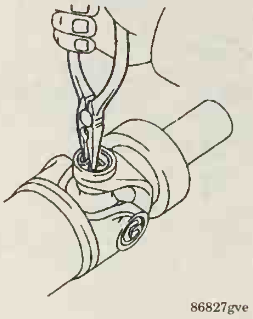


Fig. 104 Pull out the snaprings — Dana type

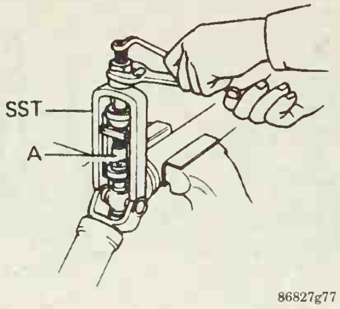


Fig. 105 An SST such as 09332-25010 is used to extract the bearings

Rear Driveshaft and U-Joints

REMOVAL & INSTALLATION

2WD Models

ONE-PIECE DRIVESHAFT

➧ See Figures 107 and 108

1. Jack up the rear of the truck and support the rear axle housing with jackstands.
2. Matchmark the two halves of the rear universal joint flange.
3. Remove the bolts which hold the rear flange together.
4. Remove the splined end of the driveshaft from the transmission.

➡Plug the end of the transmission with a rag or other device to prevent oil loss.

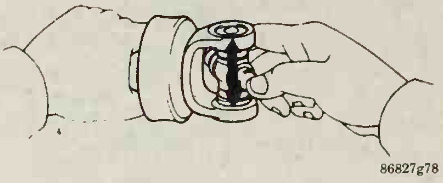


Fig. 106 Check the axial play after reassembly

5. Remove the driveshaft from under the truck.

To install:

6. Apply multi-purpose grease to the splined end of the shaft.
7. Insert the driveshaft sleeve into the transmission.

➡Be careful not to damage the extension housing grease seal.

8. Align the mating marks on the rear flange and replace the bolts. Tighten to 54 ft. lbs. (74 Nm) on all vehicles except models with 3VZ-E engines and manual transmissions. Tighten to 56 ft. lbs. (76 Nm) on these models.
9. Remove the jackstands and lower the vehicle.

TWO-PIECE DRIVESHAFT

1. Jack up the rear of the truck and support the rear axle housing on jackstands.
2. Before you begin to disassemble the driveshaft components, you must first paint accurate alignment marks on the mating flanges. Do this on the rear universal joint flange, the center flange, and on the transmission flange.
3. Remove the bolts attaching the rear universal joint flange to the drive pinion flange.
4. Drop the rear section of the shaft slightly and pull the unit out of the center bearing sleeve yoke.
5. Remove the center bearing support from the crossmember.
6. Separate the transmission output flange and remove the front half of the driveshaft together with the center bearing assembly.

To install:

7. Connect the output flange of the transmission to the flange on the front half of the shaft.
8. Install the center bearing support to the crossmember, but do not fully tighten the bolts.
9. Install the rear section of the shaft making sure that all mating marks are aligned.
10. Tighten all flange bolts to 22-36 ft. lbs. (30-49 Nm).

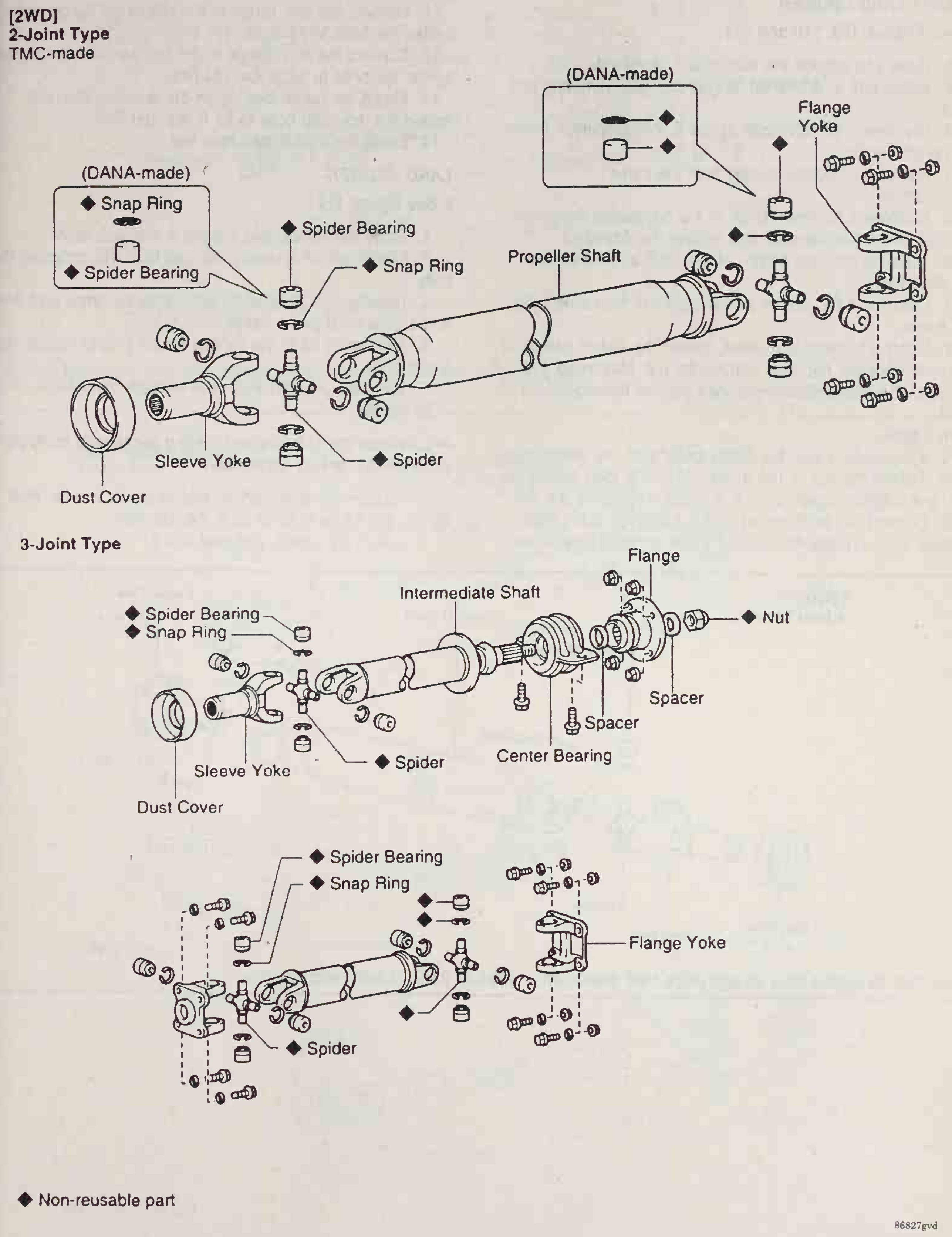

[2WD]
2-Joint Type
TMC-made
(DANA-made)
◆ Snap Ring
◆ Spider Bearing
(DANA-made)
◆
◆
Flange Yoke
◆
◆ Spider Bearing
◆ Snap Ring
Propeller Shaft
◆
Sleeve Yoke
◆ Spider
Dust Cover
3-Joint Type
Flange
Intermediate Shaft
◆ Nut
◆ Spider Bearing
◆ Snap Ring
Spacer
Spacer
Center Bearing
◆ Spider
Sleeve Yoke
Dust Cover
◆ Spider Bearing
◆ Snap Ring
◆
◆
Flange Yoke
◆
◆ Spider
◆ Non-reusable part
86827gvd

Fig. 107 Exploded view of one and two-piece rear driveshaft — 2WD Tacoma

4WD Models

EXCEPT LAND CRUISER

➧ See Figures 109, 110 and 111

1. Raise and support the vehicle with jackstands.
2. Matchmark all driveshaft flanges BEFORE removing any bolts.
3. Disconnect the driveshaft flange at the companion flange on the differential.
4. Remove the center bearing from the frame crossmember.
5. Disconnect the front flange at the companion flange on the rear of the transfer case and remove the driveshaft.
6. Separate the front portion of the shaft at the intermediate shaft flange.
7. Disconnect the rear of the driveshaft at the center bearing flange.
8. Using a hammer and chisel, loosen the staked portion of the center bearing nut, then remove the nut. Matchmark the flange to the intermediate shaft, then pull the bearing off the shaft.

To install:

9. If equipped, install the center bearing on the intermediate shaft. Tighten the nut to 134 ft. lbs. (181 Nm), then loosen the nut, and retighten again to 51 ft. lbs. (69 Nm). Stake the nut.
10. Connect the front portion of the driveshaft to the intermediate shaft and the rear portion to the center flange. Make sure the marks all line up, then tighten the bolts to 54 ft. lbs. (74 Nm).
11. Connect the rear flange to the differential flange and tighten the bolts to 54 ft. lbs. (74 Nm).
12. Connect the front flange to the transfer case flange and tighten the bolts to 54 ft. lbs. (74 Nm).
13. Mount the center bearing on the crossmember and tighten the mounting bolts to 27 ft. lbs. (36 Nm).
14. Lower the vehicle and road test.

LAND CRUISER

➧ See Figure 112

1. Raise the vehicle and support it with jackstands.
2. Matchmark all driveshaft flanges BEFORE removing the bolts.
3. Unfasten the bolts which secure the universal joint flange to the differential pinion flange.
4. Matchmark all of the flanges for the joint-to-transfer case flange bolts.
5. Withdraw the driveshaft from beneath the vehicle.

To install:

➡Lubricate the U-joints and sliding joints with multi-purpose grease before installation.

6. Position the driveshaft so that all marks line up, then tighten the flange bolts to 65 ft. lbs. (88 Nm).
7. Lower the vehicle and road test it.

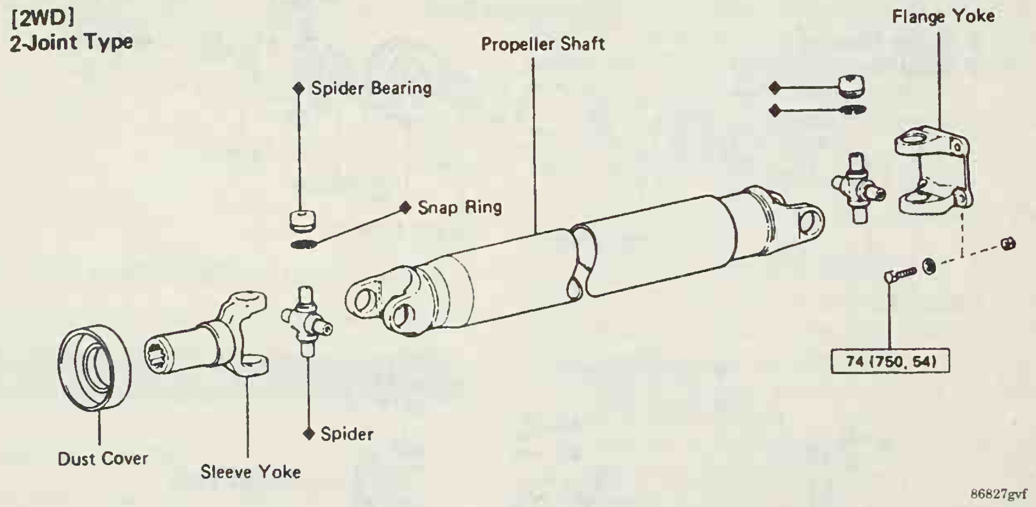


Fig. 108 Exploded view of one-piece rear driveshaft — 1989-95 2WD Pick-Up and 4Runner

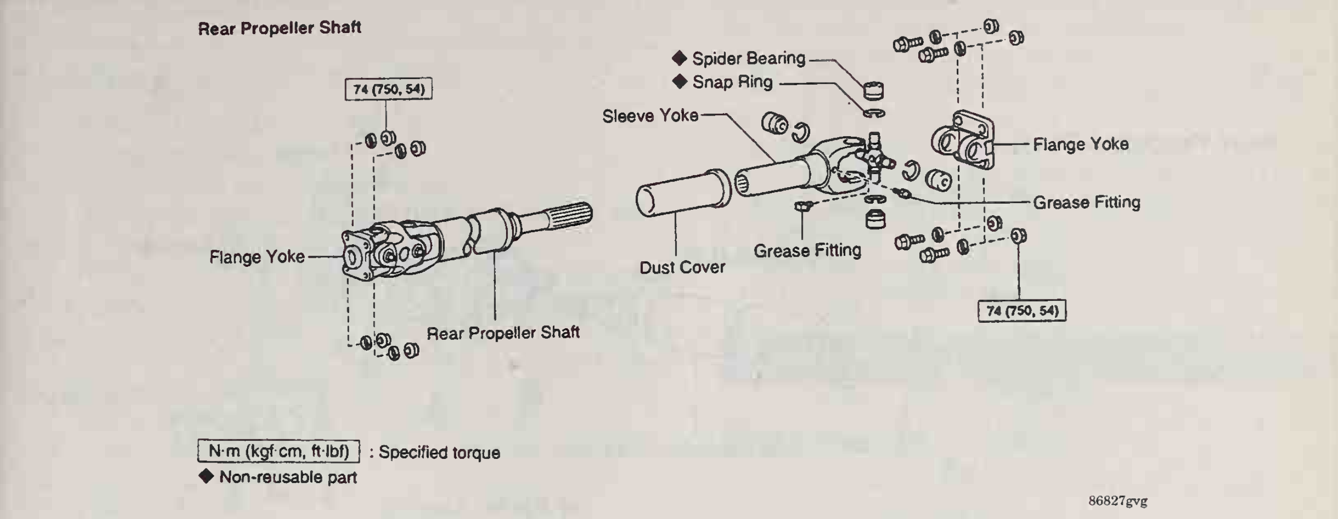

Rear Propeller Shaft
74 (750, 54)
◆ Spider Bearing
◆ Snap Ring
Sleeve Yoke
Flange Yoke
Grease Fitting
Flange Yoke
Dust Cover
Grease Fitting
74 (750, 54)
Rear Propeller Shaft
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827gvg

Fig. 109 Exploded view of one-piece rear driveshaft — 1996 4WD 4Runner

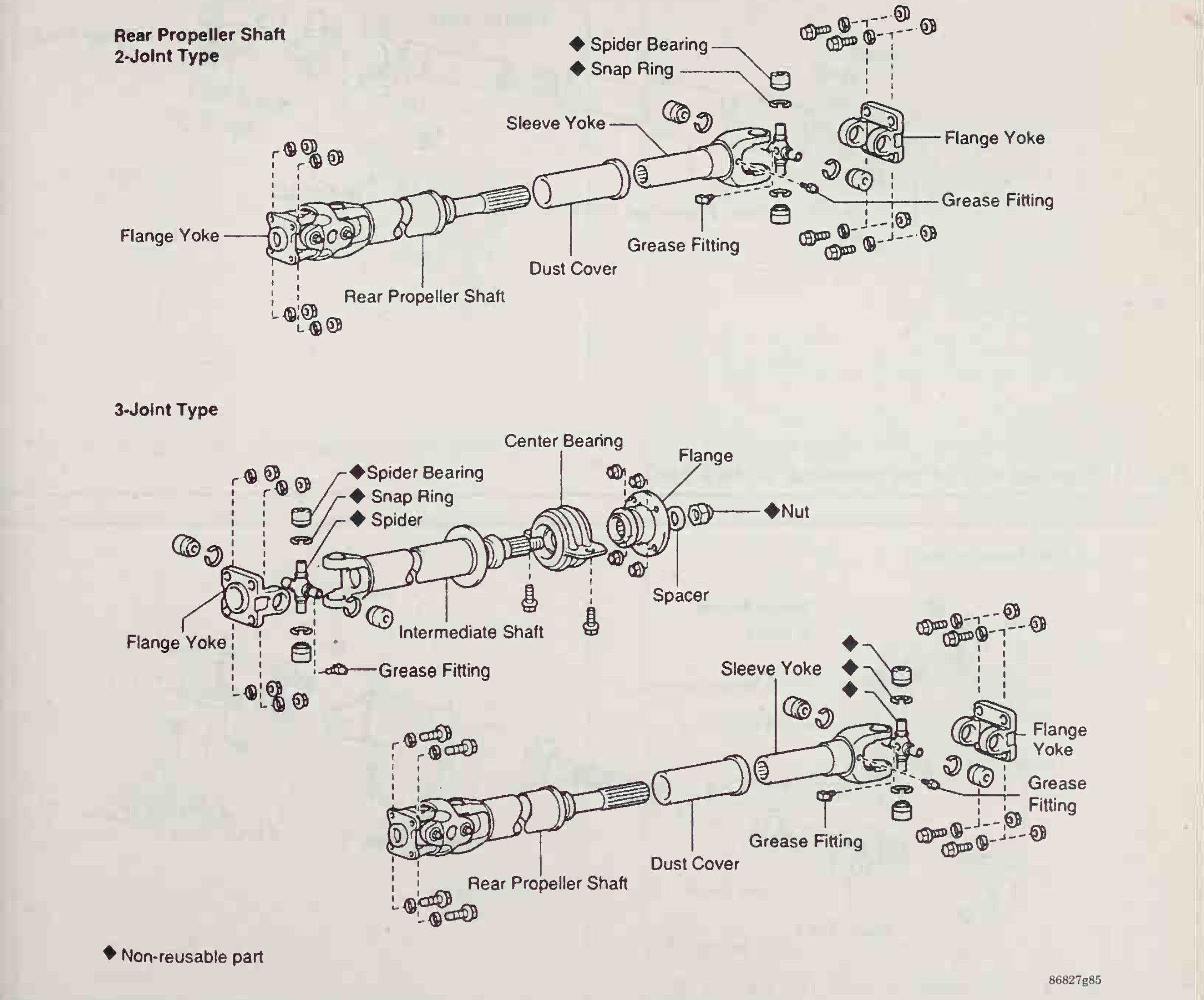

Rear Propeller Shaft
2-Joint Type
◆ Spider Bearing
◆ Snap Ring
Sleeve Yoke
Flange Yoke
Flange Yoke
Grease Fitting
Grease Fitting
Dust Cover
Rear Propeller Shaft
3-Joint Type
Center Bearing
Flange
◆Spider Bearing
◆ Snap Ring
◆ Spider
◆Nut
Spacer
Flange Yoke
Intermediate Shaft
Grease Fitting
Sleeve Yoke
Flange Yoke
Grease Fitting
Grease Fitting
Dust Cover
Rear Propeller Shaft
◆ Non-reusable part
86827g85

Fig. 110 Exploded view of one and two-piece rear driveshaft — 4WD Tacoma

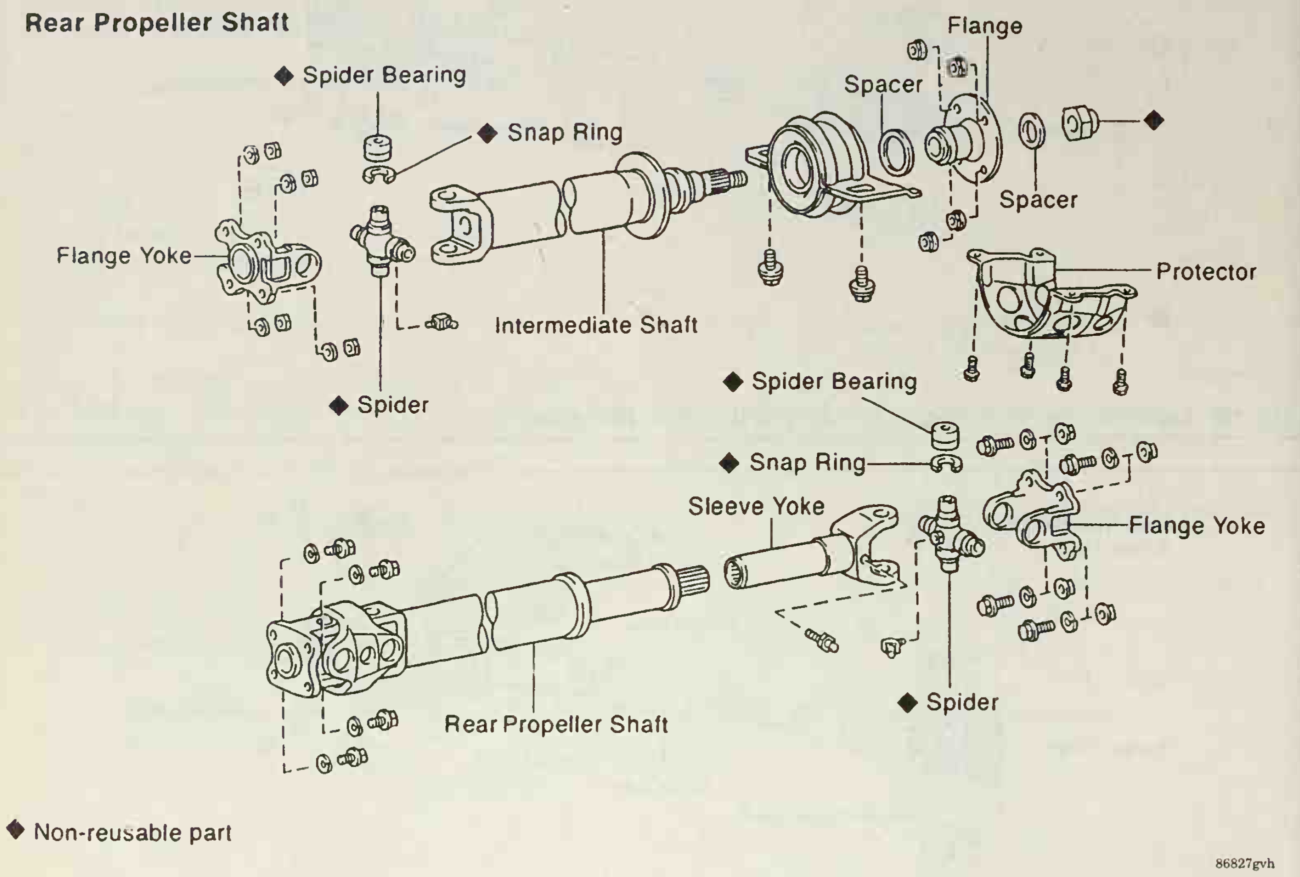

Rear Propeller Shaft
◆ Spider Bearing
◆ Snap Ring
Flange
Spacer
Spacer
Flange Yoke
Intermediate Shaft
Protector
◆ Spider
◆ Spider Bearing
◆ Snap Ring
Sleeve Yoke
Flange Yoke
Rear Propeller Shaft
◆ Spider
◆ Non-reusable part
86827gvh

Fig. 111 Exploded view of rear driveshaft — 4WD T100

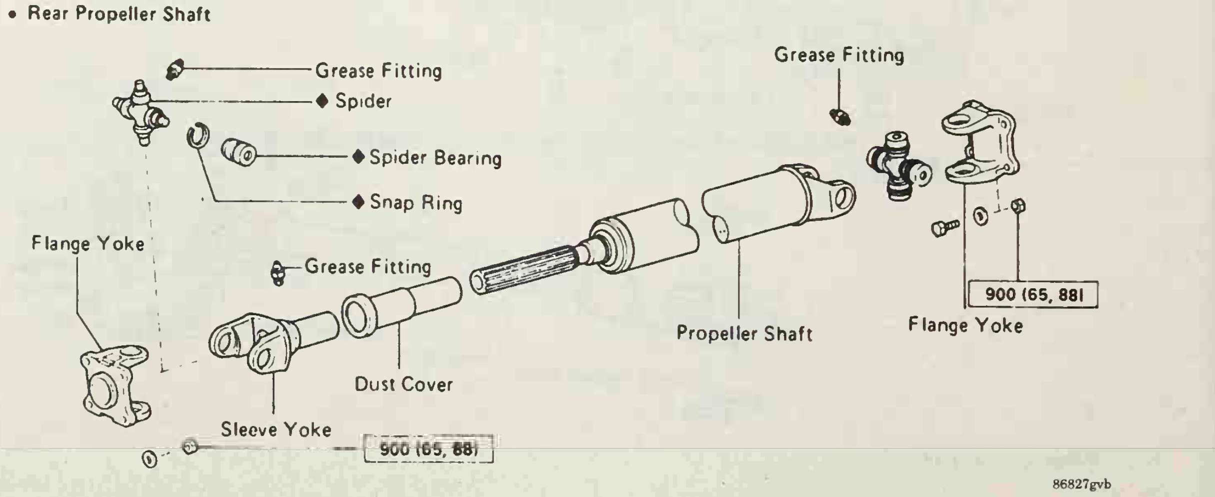

• Rear Propeller Shaft
Grease Fitting
◆ Spider
◆ Spider Bearing
◆ Snap Ring
Grease Fitting
Flange Yoke
Grease Fitting
Dust Cover
Sleeve Yoke
900 (65, 88)
Propeller Shaft
900 (65, 88)
Flange Yoke
86827gvb

Fig. 112 Exploded view of rear driveshaft — Land Cruiser

U-JOINT REPLACEMENT

➧ See Figures 113, 114, 115, 116 and 117

1. Raise and support the vehicle.
2. Remove the driveshaft.
3. Matchmark the yoke and the driveshaft.
4. Remove the snaprings from the bearings. There are two types of snaprings: Toyota and Dana.
5. Position the yoke on vise jaws. Using a bearing remover and a hammer, gently tap the remover until the bearing is driven out of the yoke about 1 in. (25mm).
6. Place the tool in the vise and drive the yoke away from the tool until the bearing is removed.
7. Repeat Steps 4 and 5 for the other bearings.
8. Check for worn or damaged parts. Inspect the bearing journal surfaces for wear.

To assemble:

9. Install the bearing cups, seals, and O-rings in the spider.
10. Apply multi-purpose grease to a new spider and bearings. Be careful not to apply too much grease.
11. Position the spider into the yoke.
12. Start the bearings in the yoke, then press them into place, using a vise.
13. Repeat Step 5 for the other bearings.
14. If the axle play of the spider is greater than 0.0020 in. (0.05mm), select snaprings which will provide the correct play. Be sure that the snaprings are the same size on both sides or driveshaft noise and vibration will result.
15. Check the U-joint assembly for smooth operation.

Center Bearing

REMOVAL & INSTALLATION

The center support bearing is a sealed unit which requires no periodic maintenance. The following procedure should be

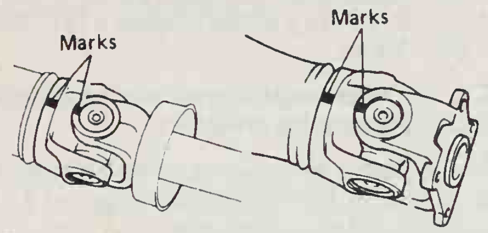


Fig. 113 Always place matchmarks on the spider and yoke

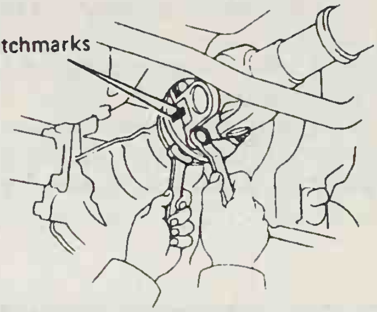


Fig. 115 Place matchmarks on the flanges, then loosen and remove the bolts

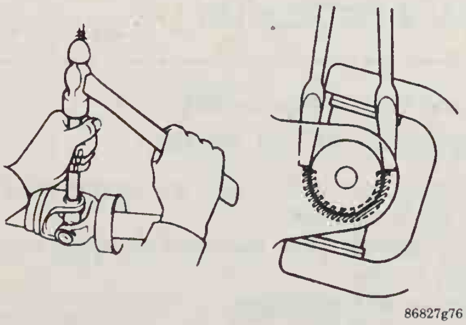


Fig. 114 Tap out the Toyota type snaprings

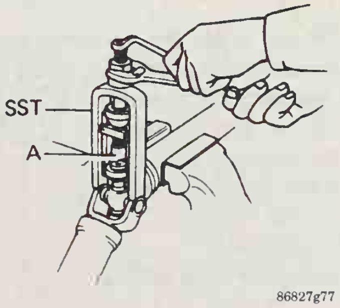


Fig. 116 An SST such as 09332-25010 is used to extract the bearings

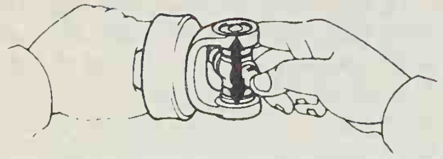


Fig. 117 Check the axial play after reassembly

used if it becomes necessary to replace the bearing. Toyota does not supply individual parts for the bearing replacement only the assembly. See your local jobber if necessary.

1. Remove the intermediate driveshaft and the center support bearing assembly.
2. Paint mating marks on the universal joint flange and the intermediate driveshaft.
3. Remove the cotter pin and castle nut from the intermediate driveshaft; the nut will be staked. Remove the universal joint flange from the driveshaft using a press.
4. Remove the center support bearing assembly from the driveshaft.
5. Remove the two bolts from the bearing housing and remove the housing.
6. Remove the dust deflectors from both sides of the bearing cushion. Remove the dust deflectors from either side of the bearing.
7. Remove the snaprings from each side of the bearing. This is easy to do if you have a snapring tool which fits the holes in the ring, and very difficult otherwise. Remove the bearing.

To assemble:

8. Install the new bearing into the cushion and fit a snapring on each side.
9. Apply a coat of multi-purpose grease to the dust deflectors and put them in their respective places on each side of the bearing. The single deflector with a slightly larger diameter goes on the rear of the bearing.
10. Press the dust deflector onto each side of the cushion. The water drain holes in the deflectors should be in the same position on each side of the cushion. The water drain holes should face the bottom of the housing.
11. Press the support bearing assembly firmly onto the intermediate driveshaft, with the seal facing front.
12. Match the mating marks painted earlier, and install the universal joint flange to the driveshaft. Install the center bearing on the intermediate shaft and tighten the nut to 134 ft. lbs. (181 Nm). Loosen the nut and then retighten it to 51 ft. lbs. (69 Nm). Stake the nut.

➡Check to see if the center support bearing assembly will rotate smoothly around the driveshaft.

13. When reinstalling the driveshaft, be certain to match up the marks on both the front transmission flange and the flange on the sleeve yoke of the rear driveshaft.

FRONT DRIVE AXLE

Manual Locking Hub

REMOVAL & INSTALLATION

➧ See Figures 118, 119, 120, 121, 122, 123, 124, 125, 126, 127 and 128

1. Remove the hub cover. Set the control handle to free.
2. Remove the cover mounting bolts, then pull off the cover. Remove and discard the gasket.
3. Remove the bolt with washer.
4. Remove the mounting nuts and washers.
5. Using a brass bar and hammer, tap on the bolt ends, then remove the cone washers.
6. Pull off the hub body.
7. Remove and discard the gasket.

To install:

8. Place a new gasket into position on the front axle hub. Install the free wheeling hub body with the cones washers and nuts. Tighten the nuts to 23 ft. lbs. (31 Nm).
9. Install the bolt with washer, tighten to 13 ft. lbs. (18 Nm).
10. Apply multi-purpose grease to the inner hub splines.
11. Set the control handle and clutch to the free position.
12. Place a new gasket into position on the cover.
13. Install the cover to the body with the follower pawl tabs aligned with the non toothed portions of the body.
14. Tighten the cover mounting bolts to 7 ft. lbs. (10 Nm).

Front Axle, Bearing and Seal

REMOVAL & INSTALLATION

Pick-Up and 1989-95 4Runner 4WD

➧ See Figures 129, 130, 131 and 132

1. Raise the front of the vehicle and support on safety stands. Remove the wheel.
2. On models with ABS, disconnect the speed sensor from the steering knuckle.
3. Remove the brake caliper.
4. Remove the hub.
5. Disconnect and plug the brake line at the disc and secure it out of the way.
6. Pop off the axle nut lockwasher, then remove the nut, washer and adjusting nut. Remove the axle hub/brake rotor as an assembly along with the outer wheel bearing.

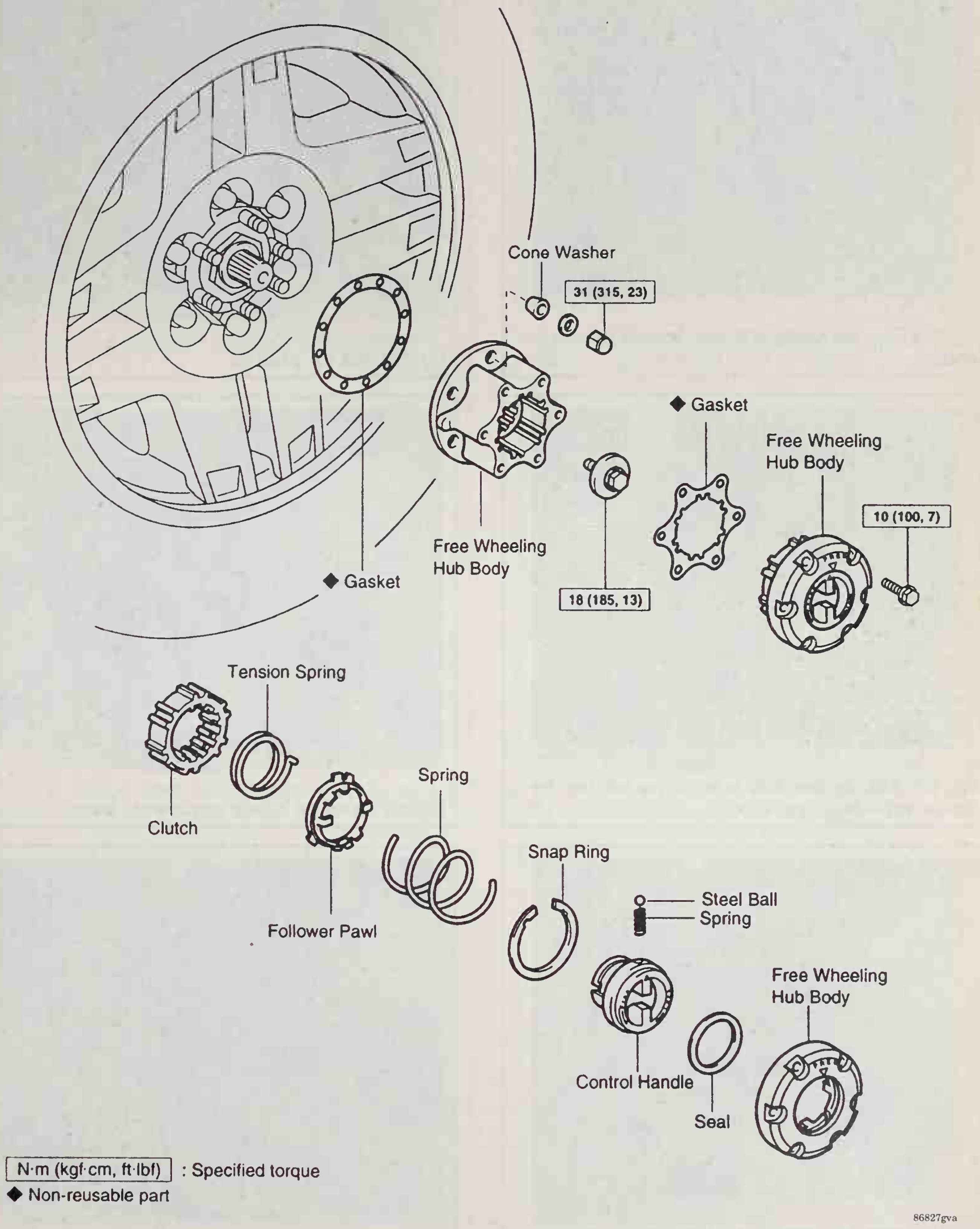
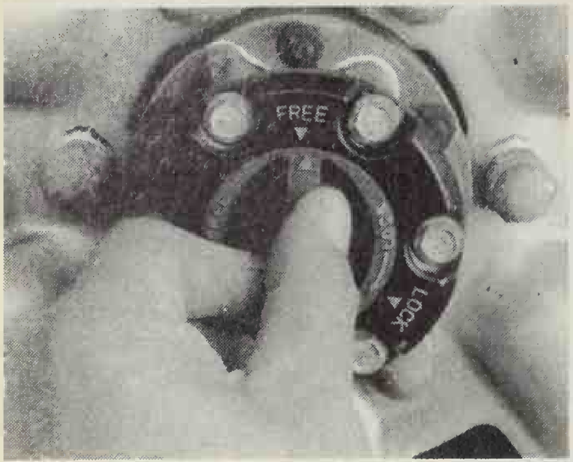
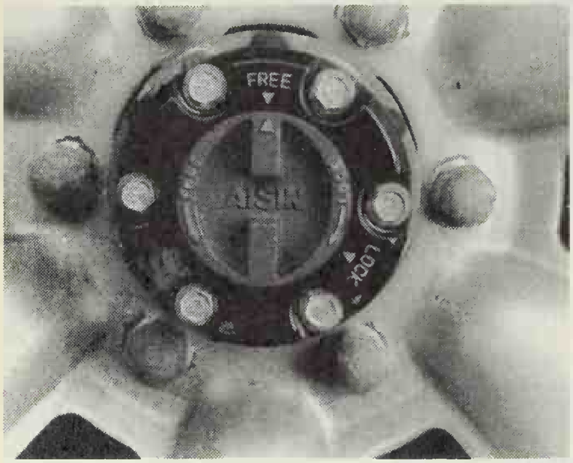

Cone Washer
31 (315, 23)
◆ Gasket
Free Wheeling Hub Body
10 (100, 7)
18 (185, 13)
Free Wheeling Hub Body
◆ Gasket
Tension Spring
Clutch
Spring
Follower Pawl
Snap Ring
Steel Ball
Spring
Free Wheeling Hub Body
Control Handle
Seal
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827gva

Fig. 118 Exploded view of the free wheeling hub



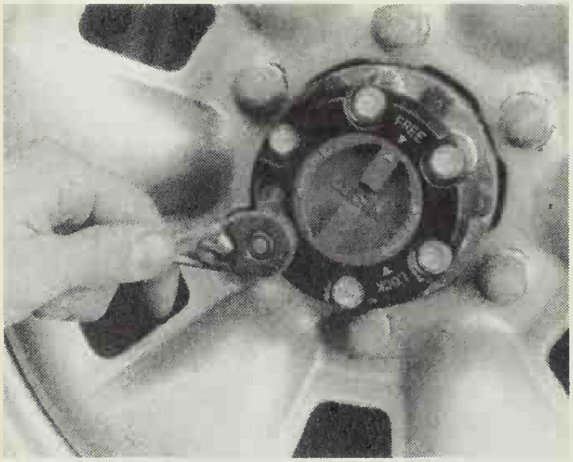
86827p19

Fig. 119 Turn the handle with your hand to the free position



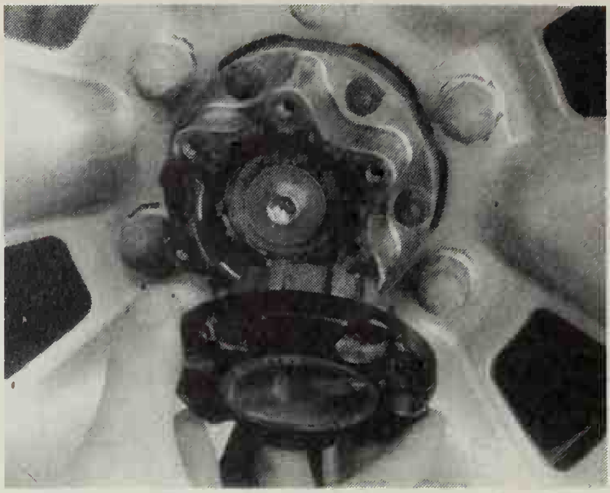
86827p20

Fig. 120 Note the directions in which you can turn the handle: left — free, right — lock



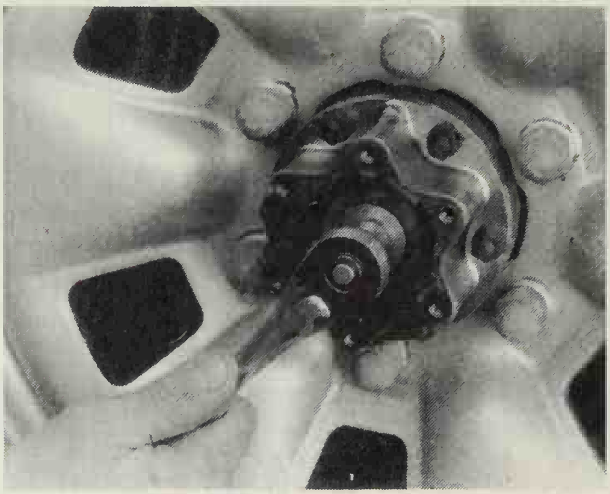
86827p11

Fig. 121 With the handle in the free position, remove the six hub cover bolts



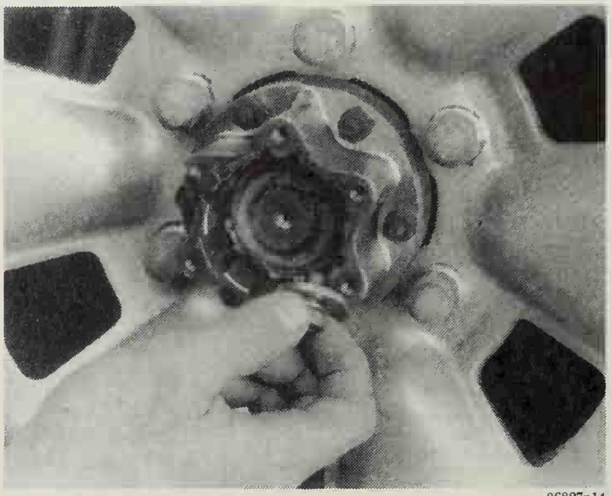
86827p12

Fig. 122 Pull the cover off



86827p13

Fig. 123 Using the correct size wrench, loosen . . .



86827p14

Fig. 124 . . . then remove the center bolt and washer

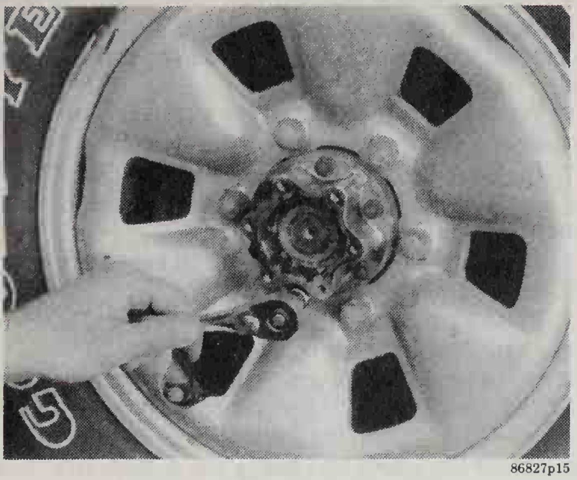


Fig. 125 Next, remove the outside mounting nuts and washers

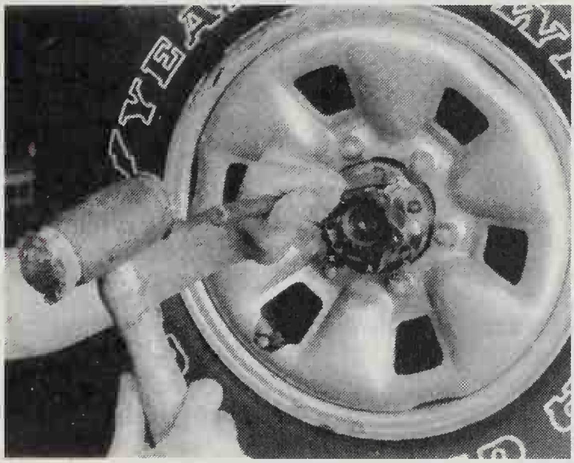


Fig. 126 Using a brass bar and hammer, tap on the bolt ends . . .

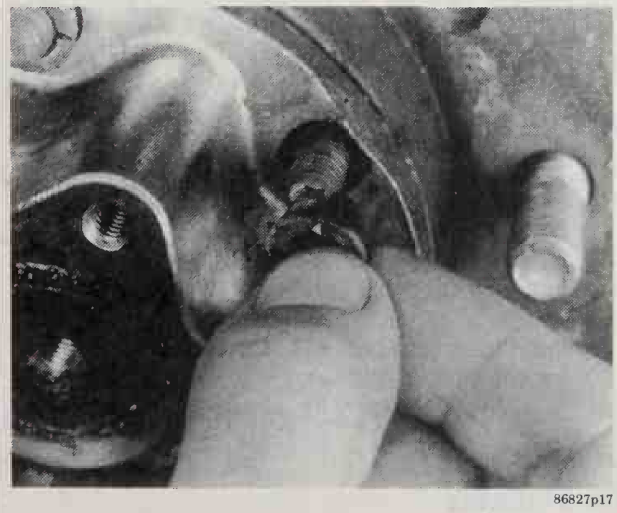


Fig. 127 . . . then remove the cone washers

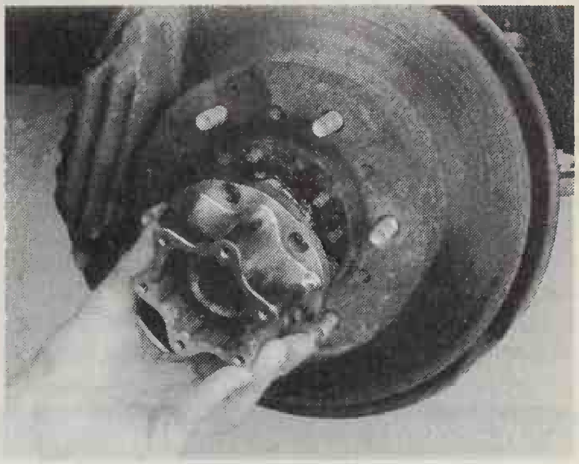


Fig. 128 The free wheeling body should come off easily; be sure to discard the old gaskets

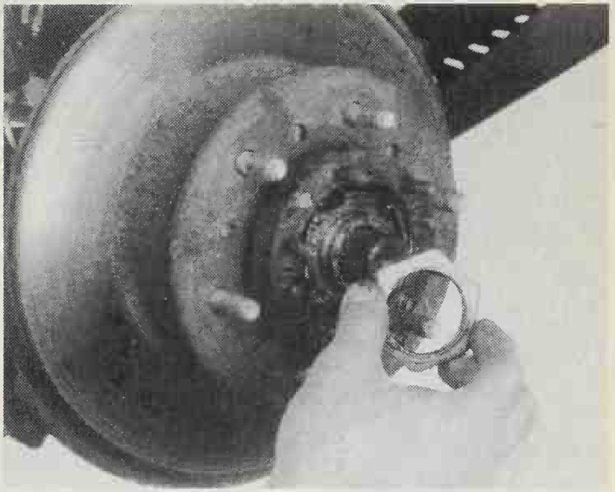


Fig. 129 Remove the axle nut lockwasher . . .

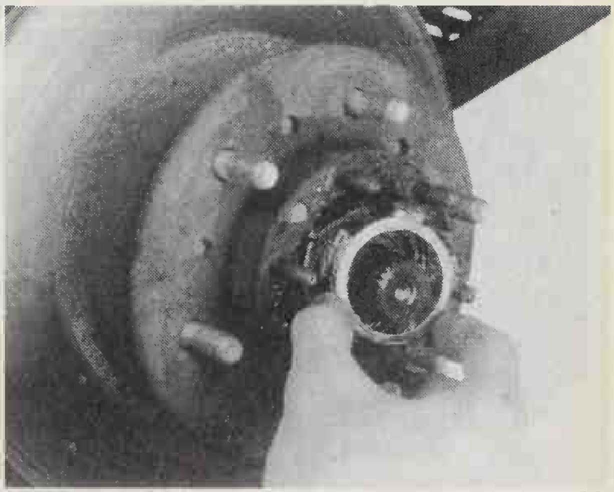


Fig. 130 . . . the nut . . .

7. Pry out the oil seal and remove the inner bearing from the hub.

8. Loosen the 6 axle shaft-to-differential housing nuts.

9. Remove the snapring and spacer from the end of the axle shaft.

10. Separate the inboard axle shaft flange from the side gear shaft and then remove the shaft down and through the steering knuckle.

To install:

11. Coat the outboard end of the axle shaft with lithium grease.

12. Insert the outboard end of the shaft into the steering knuckle and then install it to the differential. Hand tighten the bolts.

⁂WARNING

Do not damage the axle shaft boots.

13. Install the spacer and a new snapring.

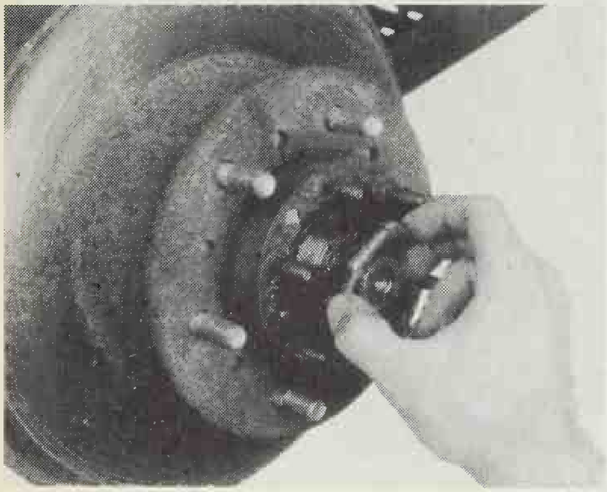

86827p24

Fig. 131 . . . and adjusting nut

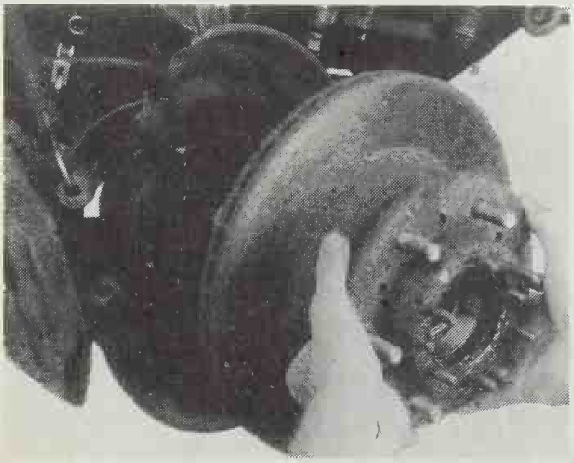

86827p25

Fig. 132 The hub and rotor will come off as an assembly

14. Tighten the inner mounting nuts to 61 ft. lbs. (83 Nm).

15. Pack the inner axle bearing with grease and press it into the hub. Coat a new oil seal with grease and press it into the hub.

16. Position the axle hub/brake disc assembly on the steering knuckle and press in the outer bearing.

17. Tighten the bearing adjusting nut to 43 ft. lbs. (59 Nm) and spin the hub a few times. Loosen the nut, then retighten to 18 ft. lbs. (25 Nm).

18. Use a tension gauge and check that the bearing preload is 6.4-12.6 lbs. (28-56 N).

19. Install a new locknut and washer, tighten to 35-58 ft. lbs. (47-78 Nm). Check that the bearing has no play.

20. Use a tension gauge and check that the bearing preload is 6.4-12.6 lbs. (28-56 N). If the preload is not within specifications, adjust it again with the adjusting nut.

21. Secure the locknut by bending one of the washer teeth inward and another outward.

22. Install the hub.

23. Install the brake caliper and line.

24. If removed, attach the ABS speed sensor to the knuckle.

25. Install the wheel, lower the vehicle and bleed the brakes.

26. Road test the truck.

T100, Tacoma and 1996 4Runner

▶ See Figure 133

1. Loosen the lug nuts.
2. Raise and support the vehicle.
3. Remove the front wheels.
4. Remove the shock absorber.
5. Pull off the grease cap.
6. Disconnect the driveshaft. Remove the cotter pin and lock cap.
7. With a helper applying the brakes, remove the locknut.
8. On vehicles with ABS, remove the speed sensor and harness from the steering knuckle.
9. Remove the brake line from the knuckle.
10. Remove the caliper and rotor.
11. Remove the bolts retaining the lower ball joint, separate from the vehicle.
12. Remove the cotter pin and loosen the nut on the axle hub. Using a SST or equivalent, remove the steering knuckle.

To install:

13. Attach the steering knuckle with hub axle to the vehicle, tighten the hub nut to 80 ft. lbs. (108 Nm).
14. Attach the lower ball joint, tighten to 59 ft. lbs. (80 Nm).
15. Install the disc and caliper.
16. Place the brake line bracket on the steering knuckle, tighten to 21 ft. lbs. (28 Nm).
17. Install the ABS sensor (if equipped) and harness.
18. Install the driveshaft. Tighten the locknut to 174 ft. lbs. (235 Nm).
19. Install the grease cap.
20. Install the shock absorber.
21. Install the wheel, lower the vehicle, tighten the lug nuts.

Land Cruiser

1989-91 MODELS

1. Raise and support the vehicle securely and remove the wheel assembly.

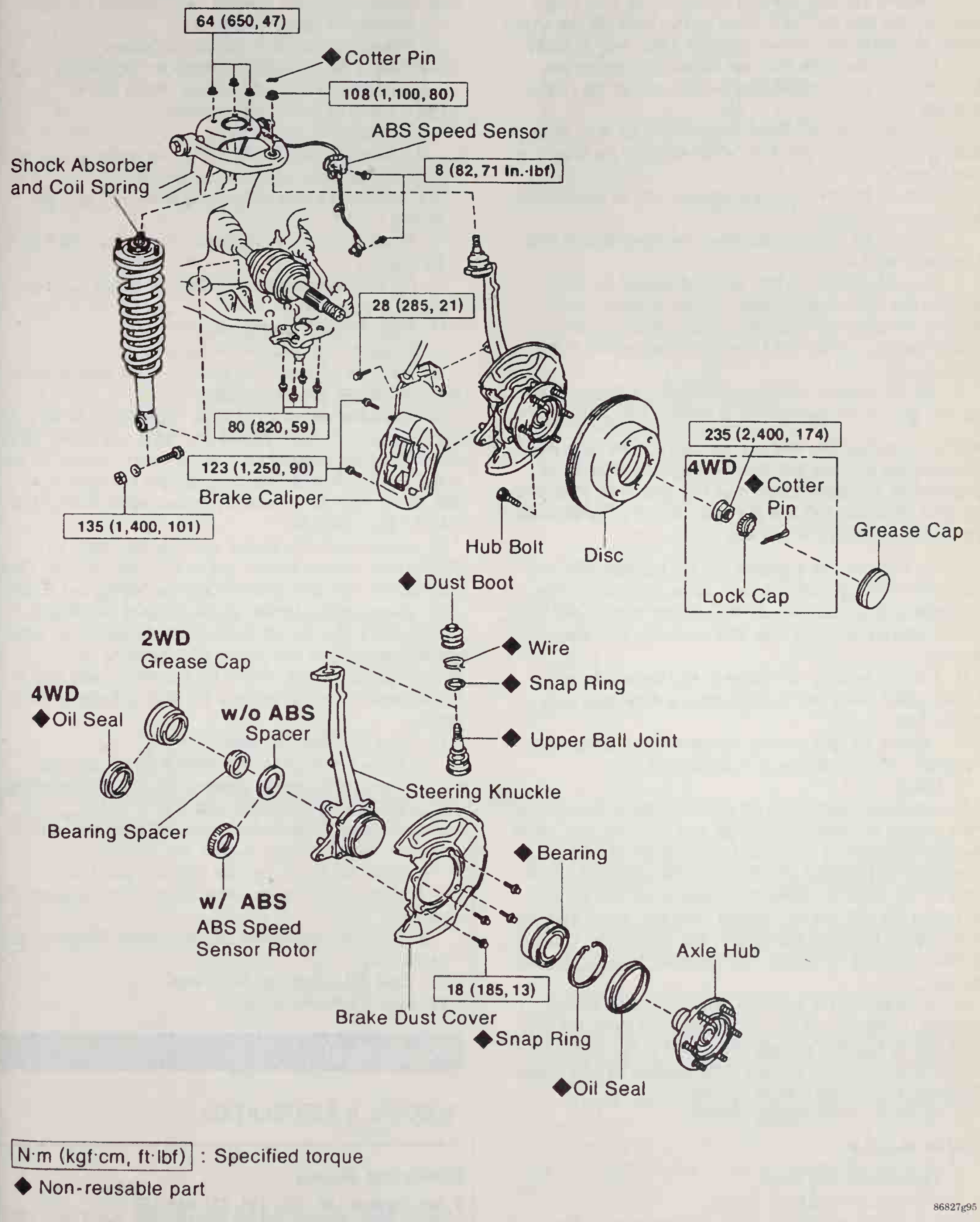

64 (650, 47)
◆Cotter Pin
108 (1,100, 80)
ABS Speed Sensor
Shock Absorber and Coil Spring
8 (82, 71 In.-lbf)
28 (285, 21)
80 (820, 59)
123 (1,250, 90)
Brake Caliper
135 (1,400, 101)
Hub Bolt
Disc
235 (2,400, 174)
4WD
◆Cotter Pin
Grease Cap
Lock Cap
◆ Dust Boot
◆ Wire
◆ Snap Ring
◆ Upper Ball Joint
2WD
Grease Cap
4WD
◆Oil Seal
w/o ABS
Spacer
Bearing Spacer
Steering Knuckle
w/ ABS
ABS Speed Sensor Rotor
◆Bearing
18 (185, 13)
Brake Dust Cover
◆Snap Ring
Axle Hub
◆Oil Seal
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g95

Fig. 133 Exploded view of the front axle hub and components — 1996 4Runner shown

2. Remove the outer axle shaft flange cap, and then remove the shaft snapring on the outer shaft.
3. Remove the bolts retaining the outer axle shaft flange onto the front axle hub, then screw service bolts into the shaft flange alternately, and remove the shaft flange with its gasket.
4. Remove the brake drum set screws and remove the brake drum. If equipped with disc brakes, remove the caliper and disc.
5. Straighten the lockwasher, and remove the front wheel bearing adjusting nuts with front wheel adjusting nut wrench or similar tool.
6. Remove the front axle hub together with its claw washer, bearings, and oil seal.
7. Remove the clip and disconnect the brake flexible hose from the brake tube.
8. Cut and remove the lock wire and remove the bolts retaining the brake backing plate onto the steering knuckle. Remove the brake backing plate together wit the brake shoes, tension spring, and the wheel cylinder still assembled to the backing plate.
9. Tap the steering knuckle spindle lightly with a soft mallet, and remove the spindle with its gasket.

➡When removing the steering knuckle spindle on a vehicle equipped with the ball joint type axle shaft joint, be prepared for the disconnection of the outer axle shaft from the joint. The joint ball will fall from the joint. Try to cushion its fall or catch it if you can.

10. On those models equipped with the ball type axle shaft joint, slide the inner front axle shaft out of the axle housing. On those models equipped with the constant velocity joint type of axle, remove the entire axle shaft assembly from the axle housing.
11. Remove bushing from inside of knuckle spindle with a bearing puller. Install new bushing using a metal tube as a seating tool.
12. Remove the axle housing oil seal with a bearing puller. To install, use a metal tube as a seating tool.

To install:

13. Install the axle shaft in the reverse order of removal. On those models equipped with the ball joint type axle joint, install the inner axle with its proper spacer in position until the splines are fully meshed with the differential side gear splines. Next, fill the steering knuckle three quarters full with grease and place the joint ball on the inner shaft end. Install the outer shaft and the front axle shaft spacer into the steering knuckle spindle and install the spindle with its gasket onto the steering knuckle.
14. On those models equipped with the constant velocity joint axle, install the axle into the housing and rotate the axle shaft until its splines mesh with the splines in the differential. Fill the steering knuckle housing three quarters full with grease and install the steering knuckle spindle.
15. Adjust the wheel bearing preload.

1992-96 MODELS

1. Remove the front wheel.
2. Remove the front brake caliper.
3. Using a flat bladed too and a hammer, remove the grease cap from the flange.
4. Using a snapring expander, remove the snapring.
5. Loosen the 6 mounting nuts.
6. Using a brass bar and a hammer, tap on the bolt heads, then remove the 6 cone washers, plate washers and nuts.
7. Remove the flange and gasket.
8. Remove the axle hub and disc as follows:
   a. With a flat bladed tool, release the lockwasher.
   b. Remove the locknut, this may require SST 09607-60020 or an equivalent socket.
   c. Remove the lockwasher.
   d. Using SST 09607-60020 or an equivalent socket, remove the adjusting nut and thrust washer.
   e. Remove the hub and rotor together with the outer bearing.
9. Remove the oil seal and inner bearing from the hub.

To install:

10. Pack the bearing with multi-purpose grease. Coat the inside of the hub also.
11. Place the inner bearing into the hub.
12. Install the new oil seal into the hub.
13. Place the axle hub with the rotor to the spindle. Install the outer bearing and thrust washer.
14. Adjust the preload, tighten the adjusting nut to 43 ft. lbs. (59 Nm). Turn the hub right and then left 2 or 3 times. Tighten the adjusting nut again to 43 ft. lbs. (59 Nm). Loosen the nut until it can be turned by hand. Tighten the nut again to 48 inch lbs. (5 Nm). Remeasure the preload again. It should be 6.4-12.6 lbs. (28-56 N).
15. Install a new lock washer and lock nut. Using SST 09607-60020, tighten the lock nut to 47 ft. lbs. (64 Nm). Check that the axle hub turns smoothly and the bearing has no play.
16. Using a spring tension gauge, measure the preload. It should be 6.4-12.6 lbs. (28-56 N). If the preload is not within specifications, adjust with the nut after removing the lockwasher and locknut. Secure the locknut by hand one of the lockwasher teeth inward and the other lockwasher teeth outward.
17. Install the flange as follows:
   a. Place a new gasket into position on the axle hub.
   b. Apply multi-purpose grease to the inner flange splines.
   c. Install the flange to the axle hub.
   d. Place the cone washers, plate washers and nuts into position, tighten the nuts to 26 ft. lbs. (35 Nm).
   e. Install the bolt in the axle shaft and pull it out.
   f. Using a snapring expander, install a new snapring. Remove the bolts.
   g. Coat the inside of the cap with grease. Install the cap to the flange.
18. Install the caliper and front wheel.
19. Bleed the brake system.

Pinion Seal

REMOVAL & INSTALLATION

Pick-Up and 4Runner

➧ See Figures 134, 135, 136, 137 and 138

1. Elevate and safely support the vehicle.
2. Drain the differential oil.
3. Make matchmarks and remove the propeller shaft.

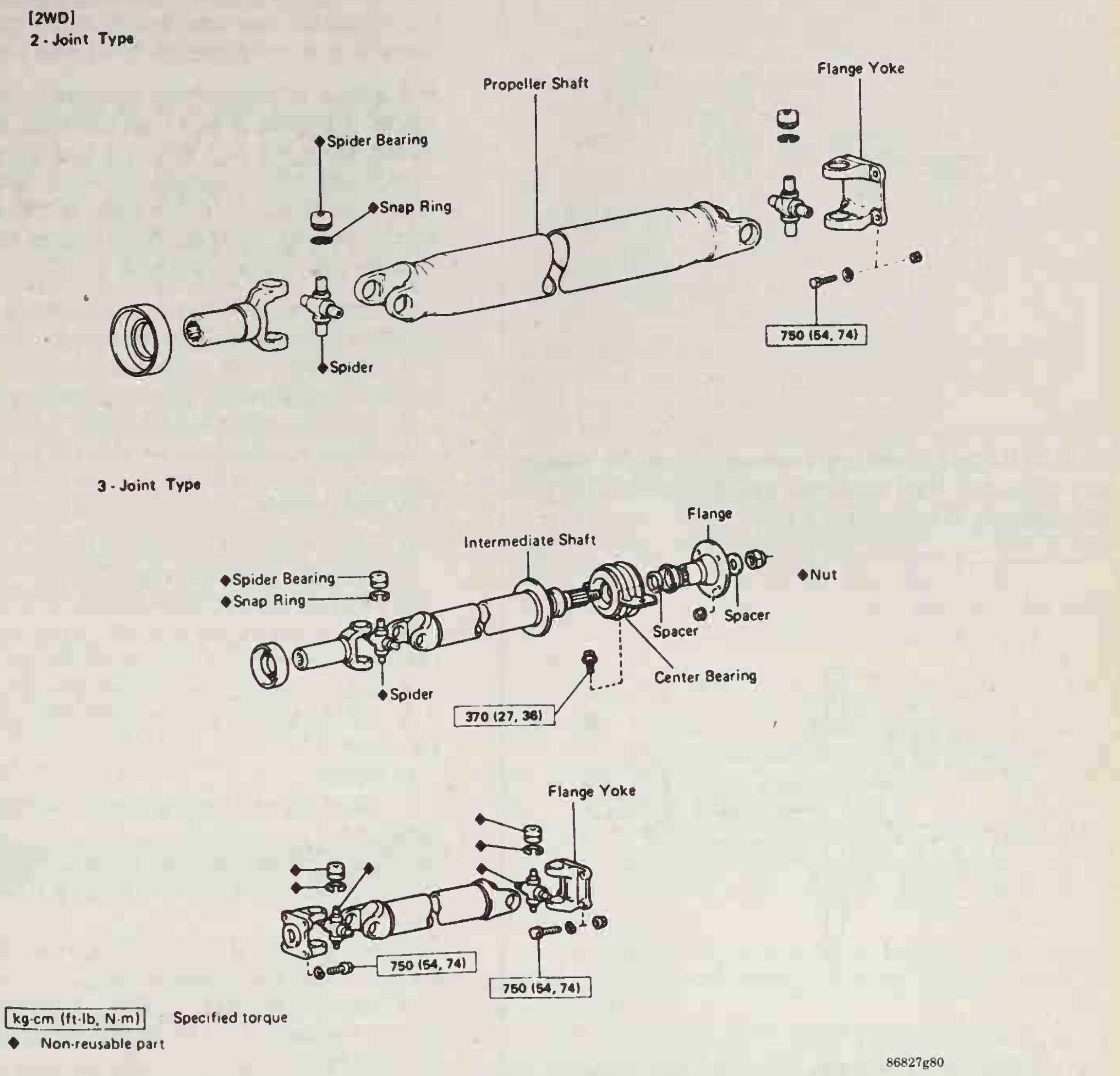

[2WD]
2 - Joint Type
Propeller Shaft
Flange Yoke
◆Spider Bearing
◆Snap Ring
◆Spider
750 (54, 74)
3 - Joint Type
Flange
Intermediate Shaft
◆Spider Bearing
◆Snap Ring
◆Nut
Spacer
Spacer
Center Bearing
◆Spider
370 (27, 36)
Flange Yoke
750 (54, 74)
750 (54, 74)
kg-cm (ft-lb, N-m) Specified torque
◆ Non-reusable part
86827g80

Fig. 134 Exploded view of the front differential axle seal components — 1989-95 models

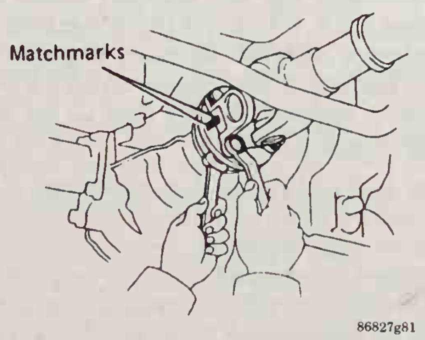

Matchmarks
86827g81

Fig. 135 Place matchmarks on the flanges, then loosen and remove the bolts

4. Loosen the staked part of the companion flange nut. Use a counterhold tool on the flange and remove the nut.
5. Use a screw-type extractor to remove the companion flange.
6. Use an extractor to remove the oil seal and oil slinger.
7. Remove the bearing spacer, bearing and oil slinger.

To install:

8. Install the new bearing spacer, rear bearing and oil slinger.
9. Install the new oil seal. Use the correct size driver to install the seal. Drive it in to a depth of 0.059 in. (1.5mm) below the lip.
10. Apply a coat of multi-purpose grease to the inner lip of the seal. Install the companion flange.
11. Coat the threads of a NEW nut with multi-purpose grease. Counterhold the flange and tighten the nut to 89 ft. lbs. (120 Nm).

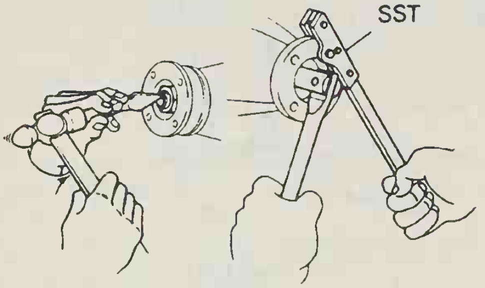


Fig. 136 Using a chisel and hammer, loosen the staked part of the nut. Hold the flange with SST 09950-30010 or equivalent and remove the nut

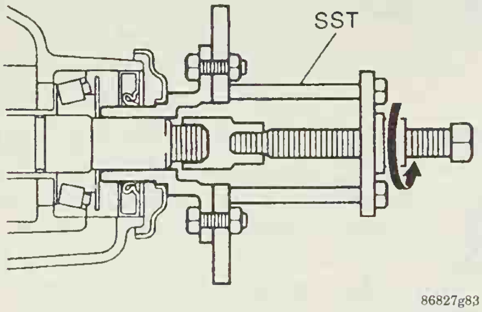


Fig. 137 This is a screw-type extractor from Toyota — Tool 09950-30010

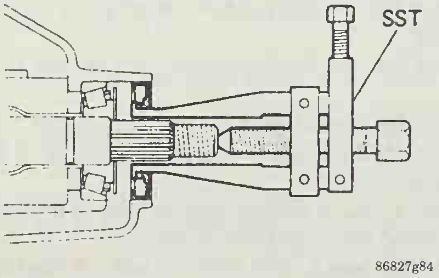


Fig. 138 The extractor fits into Seal Removal Tool 09308-10010 as shown

12. Use a torque wrench to measure pinion bearing preload. Correct preload on a used bearing is 5-9 inch lbs. (0.6-1.0 Nm) and on a new bearing is 10-17 inch lbs. (1-2 Nm).

➡If preload is greater than specified, replace the bearing spacer. If preload is less than specified, tighten the companion flange nut in 9 ft. lb. (13 Nm) increments until the correct preload is achieved. Maximum torque for the nut is 165 ft. lbs. (223 Nm). If this value is exceeded, the bearing spacer must be replaced; do NOT back off the flange nut to lower the torque or preload.

13. Check the run-out at the companion flange; maximum allowable run-out is 0.003 in. (0.10mm).
14. Stake the pinion flange nut.
15. Fill the differential with the correct amount of fluid.
16. Install the front propeller shaft.
17. Lower the vehicle to the ground.

T100 and Tacoma

1. Remove the engine undercover.
2. Drain the differential fluid.
3. Remove the front driveshaft.
4. Using a chisel and hammer, loosen the staked part of the nut. Hold the flange and remove the nut, then the flange.
5. With a seal extractor, remove the oil seal and slinger.
6. Pull the bearing from from the drive pinion, then extract the spacer.

To install:

7. Install the new bearing spacer, rear bearing and oil slinger.
8. Install the new oil seal. Use the correct size driver to install the seal. Drive it in to a depth of 0.059 in. (1.5mm) below the lip.
9. Apply a coat of multi-purpose grease to the inner lip of the seal. Install the companion flange.
10. Coat the threads of a NEW nut with multi-purpose grease. Counterhold the flange and tighten the nut to 89 ft. lbs. (120 Nm).
11. Use a torque wrench to measure pinion bearing preload. Correct preload on a used bearing is 5-9 inch lbs. (0.6-1.0 Nm) and on a new bearing is 10-17 inch lbs. (1-2 Nm).

➡If preload is greater than specified, replace the bearing spacer. If preload is less than specified, tighten the companion flange nut in 9 ft. lb. (13 Nm) increments until the correct preload is achieved. Maximum torque for the nut is 173 ft. lbs. (235 Nm). If this value is exceeded, the bearing spacer must be replaced; do NOT back off the flange nut to lower the torque or preload.

12. Check the run-out at the companion flange; maximum allowable run-out is 0.003 in. (0.10mm).
13. Stake the pinion flange nut.
14. Install the front driveshaft.
15. Fill the differential with the correct amount of fluid.
16. Install the front propeller shaft.
17. Lower the vehicle to the ground.

Land Cruiser

1. Elevate and safely support the vehicle.
2. Make matchmarks and disconnect the front propeller shaft.

3. Loosen the staked part of the companion flange nut. Use a counterhold tool on the flange and remove the nut.
4. Use screw type extractor to remove the companion flange.
5. Use an extractor to remove the oil seal and oil slinger.

To install:

6. Install the oil slinger and a new seal. Use the correct size driver to install the seal; drive it in to a depth of 0.04 in. (1.0mm) below the lip.
7. Apply a coat of multi-purpose grease to the inner lip of the seal. Install the companion flange.
8. Coat the threads of a NEW nut with multi-purpose grease. Counterhold the flange and tighten the nut to 145 ft. lbs. (196 Nm).
9. Use a torque wrench to measure pinion bearing preload. Correct preload is 4.3-6.9 inch lbs. (0.5-0.8 Nm).
10. If preload is greater than specified, replace the bearing spacer. If preload is less than specified, tighten the companion flange nut in 9 ft. lb. (13 Nm.) increments until the correct preload is achieved. Maximum torque for the nut is 253 ft. lbs. (343 Nm). If this value is exceeded, the bearing spacer must be replaced; do NOT back off the flange nut to lower torque or preload.
11. Check the run-out at the companion flange; maximum allowable run-out is 0.02 in. (0.10mm).
12. Stake the pinion flange nut.
13. Fill the differential with the correct amount of fluid.
14. Install the front propeller shaft.
15. Lower the vehicle to the ground.

Differential Carrier

REMOVAL & INSTALLATION

Pick-Up and 1989-95 4Runner

1. Elevate and support the front of the truck. Double check the placement and security of the jackstands.
2. Drain the differential oil.
3. Place matchmarks on the flanges and disconnect the propeller shaft.
4. Matchmark the driveshafts and side gear shafts. Remove the 6 nuts and disconnect the front driveshafts.
5. If equipped with Automatic Disconnecting Differential (ADD), disconnect the vacuum hoses and the 4WD indicator switch connector.
6. Remove the front mounting bolt and nut.
7. Support the differential with a floor jack. Remove the left and right rear mounting bolts and remove the front differential.

To install:

8. Support the differential and place it under the vehicle. Install the left and right rear mounting bolts, tightening them to 123 ft. lbs. (167 Nm).
9. Install the front mounting bolt, tightening it to 108 ft. lbs. (147 Nm.)
10. If equipped with Automatic Disconnecting Differential (ADD), attach the hoses and the 4WD switch harness.
11. Align the matchmarks and install the driveshafts. Tighten the nuts to 61 ft. lbs. (83 Nm).
12. Align the matchmarks and install the propeller shaft to the companion flange. Tighten the nuts to 54 ft. lbs. (74 Nm).
13. Install the drain plug if removed or double check its tightness. Install the correct amount of lubricant. Lower the vehicle to the ground.
14. Road test the vehicle, checking for noise and/or leaks.

1996 MODELS

➧ See Figure 139

1. Remove the engine undercover.
2. Drain the differential oil.
3. Disconnect the front driveshaft.
4. Place matchmarks on the driveshaft, then remove the 4 nuts, washers and bolts. Disconnect the driveshaft.
5. Remove the front differential as follows:
   a. With Automatic Disconnecting Differential (ADD), disconnect the vacuum hoses, breather hose, ADD switch harness and oil TEMP sensor connector with 2-4 selector.
   b. Without ADD, disconnect the breather hose. Remove the 2 bolts and tube from the differential.
6. Support the front differential with a suitable jack.
7. Remove the rear mounting nut and front mounting bolts.
8. Lower the jack, then remove the front differential assembly.
9. Remove the front and rear mounting cushions.

To install:

10. Attach the front and rear mounting cushions, tighten the rear to 80 ft. lbs. (108 Nm) and the front to 116 ft. lbs. (157 Nm).
11. Raise and support the differential assembly into position.
12. Install the rear mounting nut and front mounting bolts. Tighten the nuts to 64 ft. lbs. (87 Nm) and the bolts to 101 ft. lbs. (137 Nm).
13. On vehicles without ADD, attach the tube to the differential, tighten the mounting bolts to 9 ft. lbs. (13 Nm). Install the breather hose.
14. On vehicles with ADD, attach the vacuum hoses, breather hose, ADD switch harness and oil TEMP sensor connector with 2-4 selector. Attach the tube to the differential, then tighten the mounting bolts to 9 ft. lbs. (13 Nm).
15. Attach the front driveshaft, tighten to 54 ft. lbs. (74 Nm).
16. Install the driveshafts.
17. Install the drain plug if it was removed or double check its tightness. Install the proper amount of gear oil.
18. Install the engine undercover.
19. Test drive the vehicle.

T100

1. Remove the engine undercover.
2. Drain the differential oil.
3. Disconnect the front driveshaft.
4. Place matchmarks on the driveshaft and remove the 6 nuts holding the driveshaft and side gear shaft. Remove the driveshaft nuts.
5. Disconnect the vacuum hoses and the 4WD indicator switch harness.
6. Remove the crossmember.
7. Loosen and remove the mounting bolt and nut for the differential.
8. Support the front differential with a suitable jack.

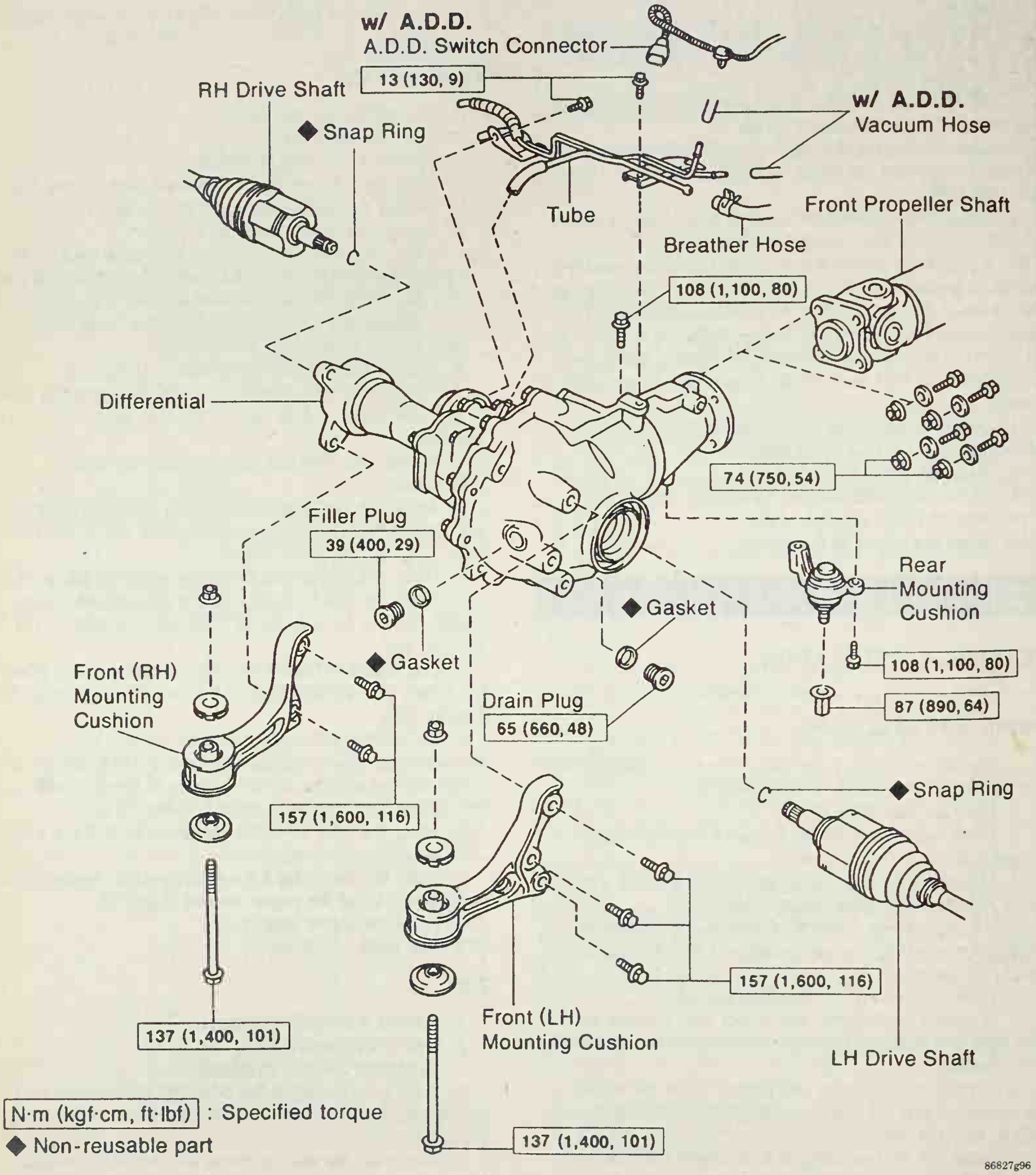

w/ A.D.D.
A.D.D. Switch Connector
13 (130, 9)
RH Drive Shaft
◆ Snap Ring
w/ A.D.D.
Vacuum Hose
Tube
Breather Hose
Front Propeller Shaft
108 (1,100, 80)
Differential
74 (750, 54)
Filler Plug
39 (400, 29)
Rear
Mounting
Cushion
◆ Gasket
◆ Gasket
108 (1,100, 80)
Front (RH)
Mounting
Cushion
Drain Plug
65 (660, 48)
87 (890, 64)
◆ Snap Ring
157 (1,600, 116)
157 (1,600, 116)
137 (1,400, 101)
Front (LH)
Mounting Cushion
LH Drive Shaft
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
137 (1,400, 101)
86827g96

Fig. 139 Exploded view of the front differential assembly — 4Runner

9. Remove the right and left rear mounting bolts. Lower the jack, then remove the differential assembly.

To install:

10. Support the differential with a jack and raise into position. Install and tighten the right and left mounting bolts to 123 ft. lbs. (167 Nm).
11. Attach the front mounting bolt and nut, tighten to 108 ft. lbs. (147 Nm).
12. Install and attach the crossmember, tighten to 93 ft. lbs. (126 Nm).
13. Attach the vacuum hoses and the 4WD indicator harness.
14. Install and tighten the driveshaft nuts to 61 ft. lbs. (83 Nm).
15. Attach the front driveshaft.
16. Install the drain plug if it was removed or double check its tightness. Install the proper amount of gear oil.
17. Install the engine undercover.
18. Test drive the vehicle.

Tacoma

➧ See Figure 140

1. Remove the engine undercover.
2. Drain the differential oil.
3. Disconnect the front driveshaft.
4. Place matchmarks on the driveshaft, then remove the 4 nuts, washers and bolts. Disconnect the driveshaft.
5. Remove the front differential as follows:
   a. With Automatic Disconnecting Differential (ADD), disconnect the vacuum hoses, breather hose, ADD switch harness and oil TEMP sensor connector with 2-4 selector.
   b. Without ADD, disconnect the breather hose. Remove the 2 bolts and tube from the differential.
6. Support the front differential with a suitable jack.
7. Remove the rear mounting nut and front mounting bolts.
8. Lower the jack, then remove the front differential assembly.
9. Remove the front and rear mounting cushions.

To install:

10. Attach the front and rear mounting cushions, tighten the rear to 80 ft. lbs. (108 Nm). and the front to 116 ft. lbs. (157 Nm).
11. Raise and support the differential assembly into position.
12. Install the rear mounting nut and front mounting bolts. Tighten the nuts to 64 ft. lbs. (87 Nm) and the bolts to 101 ft. lbs. (137 Nm).
13. On vehicles without ADD, attach the tube to the differential, tighten the mounting bolts to 9 ft. lbs. (13 Nm). Install the breather hose.
14. On vehicles with ADD, attach the vacuum hoses, breather hose, ADD switch harness and oil TEMP sensor connector with 2-4 selector. Attach the tube to the differential, then tighten the mounting bolts to 9 ft. lbs. (13 Nm).
15. Attach the front driveshaft, tighten to 54 ft. lbs. (74 Nm).
16. Install the driveshafts.
17. Install the drain plug if it was removed or double check its tightness. Install the proper amount of gear oil.
18. Install the engine undercover.
19. Test drive the vehicle.

Land Cruiser

➧ See Figures 141 and 142

Before removal on vehicles with a differential lock, turn the ignition switch to the **ON** position. Turn the lock switch to the FR/RR position, then lock the front differential. Disconnect the negative battery cable.

1. Elevate and safely support the vehicle on stands. Double check the security and placement of the stands.
2. Drain the differential oil.
3. Remove the front axle shafts.
4. Remove the cotter pin and castle nut from each end of the steering tie rod. Use a ball joint separator (NEVER a hammer) to separate the tie rod joints; remove the tie rod.
5. Disconnect the front shaft. Make matchmarks first. On vehicles with differential lock, disconnect the harness and tube.
6. Remove the ring of nuts holding the carrier and remove the carrier assembly. Do not scratch the machined surfaces during removal.

To install:

7. Place a new gasket in position on the housing. Fit the carrier into the axle and install the nuts. Tighten the nuts to 18-20 ft. lbs. (25-27 Nm).
8. On vehicles with differential lock, attach the harness and tube.
9. Connect the front driveshaft.
10. Install the tie rod.
11. Install the front driveshafts.
12. Install the drain plug if it was removed or double check its tightness. Install the proper amount of gear oil. Lower the vehicle to the ground.
13. Test drive the vehicle.
14. Check that the bleeder plug at the point of the bleeder (inside the engine area) is not damaged or worn.

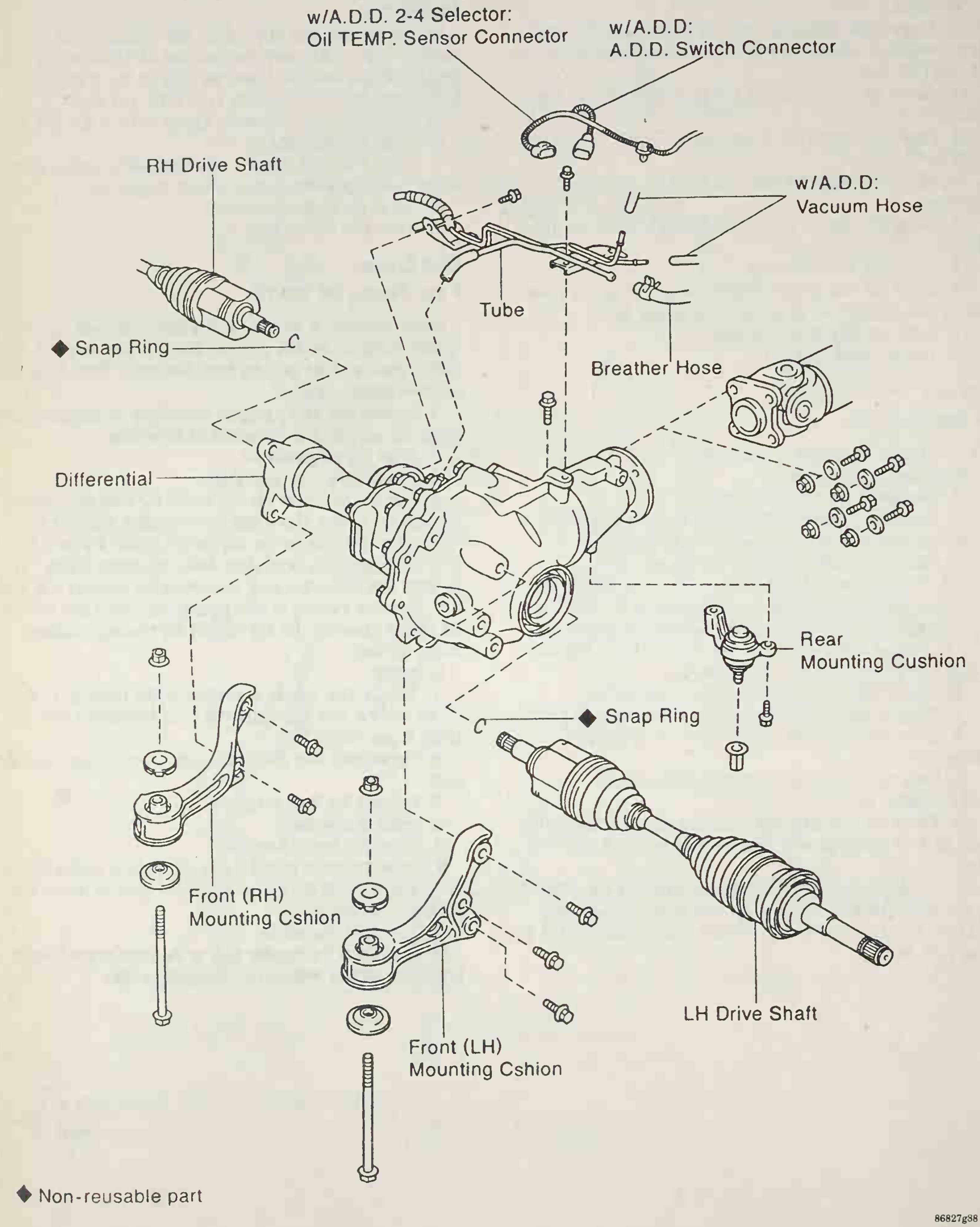

w/A.D.D. 2-4 Selector:
Oil TEMP. Sensor Connector
w/A.D.D:
A.D.D. Switch Connector
RH Drive Shaft
w/A.D.D:
Vacuum Hose
Tube
◆ Snap Ring
Breather Hose
Differential
Rear
Mounting Cushion
◆ Snap Ring
Front (RH)
Mounting Cshion
LH Drive Shaft
Front (LH)
Mounting Cshion
◆ Non-reusable part
86827g38

Fig. 140 Exploded view of the front differential assembly — Tacoma

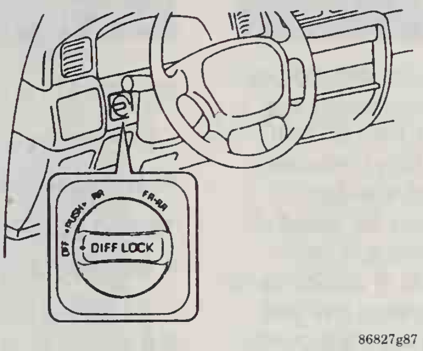

OFF
PUSH
RR
FR-RR
DIFF LOCK
86827g87

Fig. 141 If your vehicle has a differential lock, turn the lock switch to the FR/RR position, then lock the front differential

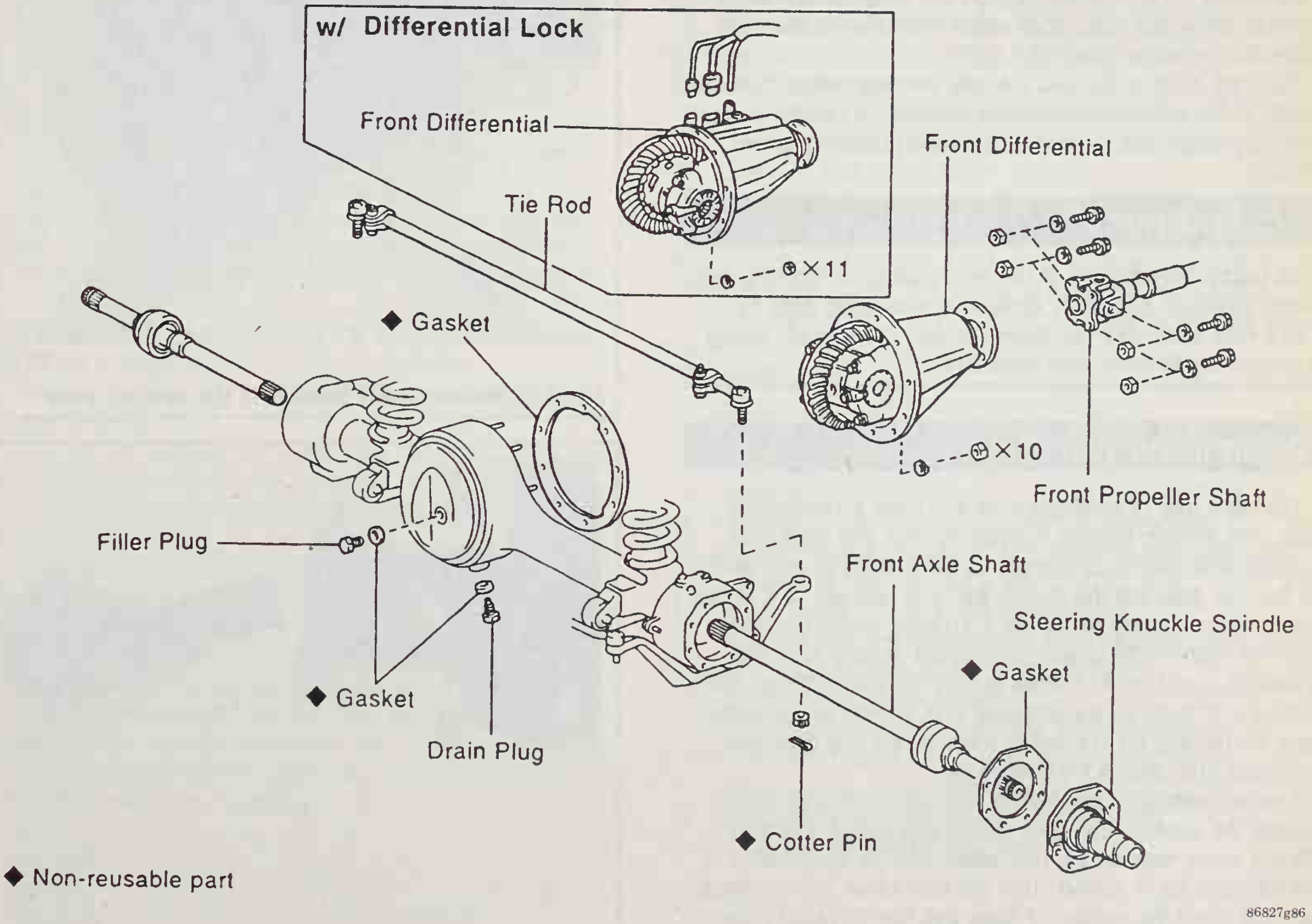

w/ Differential Lock
Front Differential
Tie Rod
×11
◆ Gasket
Front Differential
×10
Front Propeller Shaft
Filler Plug
Front Axle Shaft
Steering Knuckle Spindle
◆ Gasket
◆ Gasket
Drain Plug
◆ Cotter Pin
◆ Non-reusable part
86827g86

Fig. 142 Exploded view of the differential assembly — 1996 Land Cruiser shown

REAR DRIVE AXLE

Understanding Drive Axles

The drive axle is a special type of transmission that reduces the speed of the drive from the engine and transmission and divides the power to the wheels. Power enters the axle from the driveshaft via the companion flange. The flange is mounted on the drive pinion shaft. The drive pinion shaft and gear which carry the power into the differential turn at the speed of the transmission output shaft. The gear on the end of the pinion shaft drives a large ring gear whose axis of rotation is 90 degrees away from the of the pinion. The pinion and gear reduce the gear ratio of the axle, and change the direction of rotation to turn the axle shafts which drive both wheels. The axle gear ratio is found by dividing the number of pinion gear teeth into the number of ring gear teeth.

The ring gear drives the differential case. The case provides the two mounting points for the ends of a pinion shaft on which are mounted two pinion gears. The pinion gears drive the two side gears, one of which is located on the inner end of each axle shaft.

By driving the axle shafts through this arrangement, the differential allows the outer drive wheel to turn faster than the inner drive wheel in a turn.

The main drive pinion and the side bearings, which bear the weight of the differential case, are shimmed to provide proper bearing preload, and to position the pinion and ring gears properly.

✲✲WARNING

The proper adjustment of the relationship of the ring and pinion gears is critical. It should be attempted only by those with extensive equipment and/or experience. Doing it incorrectly is noisy and expensive.

Determining Axle Ratio

The drive axle of a vehicle is said to have a certain axle ratio. This number (usually a whole number and a decimal fraction) is actually a comparison of the number of gear teeth on the ring gear and the pinion gear. For example, a 4.11 rear means that, in theory, there are 4.11 teeth on the ring gear and one tooth on the pinion gear or, put another way, the driveshaft must turn 4.11 times to turn the wheels once. There might be 37 teeth on the ring gear and 9 teeth on the pinion gear. By dividing the number of teeth on the ring gear, the numerical axle ratio (4.11) is obtained.

Another method of determining gear ratio is to jack up and support the truck so that both rear wheels are off the ground. Make a chalk mark on the rear wheel and the driveshaft. Put the transmission in neutral. Turn the rear wheel one complete turn and count the number of turns that the driveshaft makes. The number of turns that the driveshaft makes in one complete revolution of the rear wheel is an approximation of the rear axle ratio.

Axle Shaft, Bearing and Seal

REMOVAL & INSTALLATION

Pick-Ups, 4Runner, T100 and Tacoma

1989-95 MODELS

➧ See Figures 143, 144, 145 and 146

1. Loosen the lug nuts on the wheel, then raise the truck and support it on jackstands.
2. Drain the axle housing.
3. Remove the lug nuts and remove the wheel.

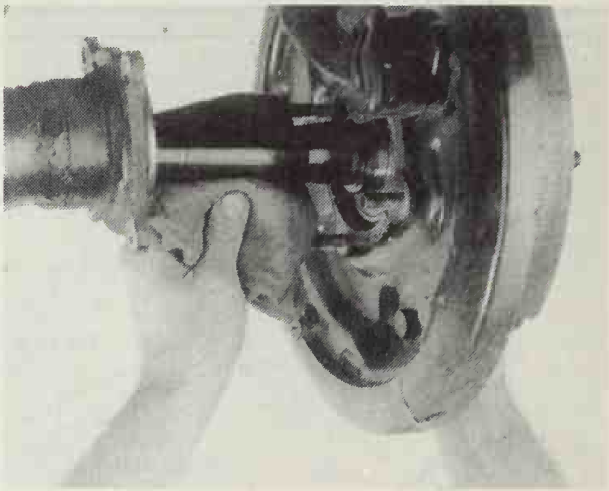

86827p27

Fig. 143 Remove the 4 bolts from the backing plate

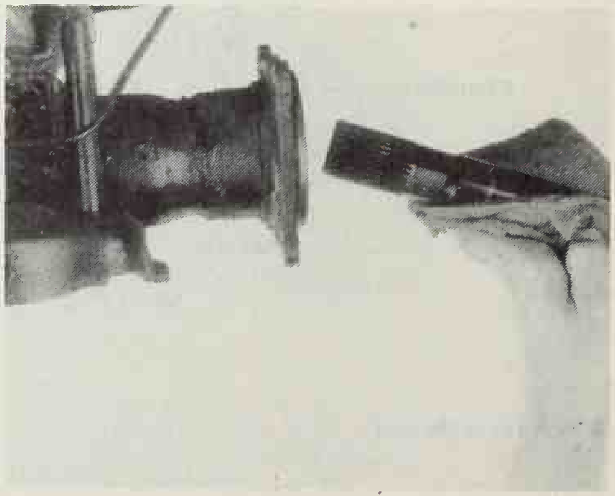

86827p28

Fig. 144 Slide the axle shaft from the housing

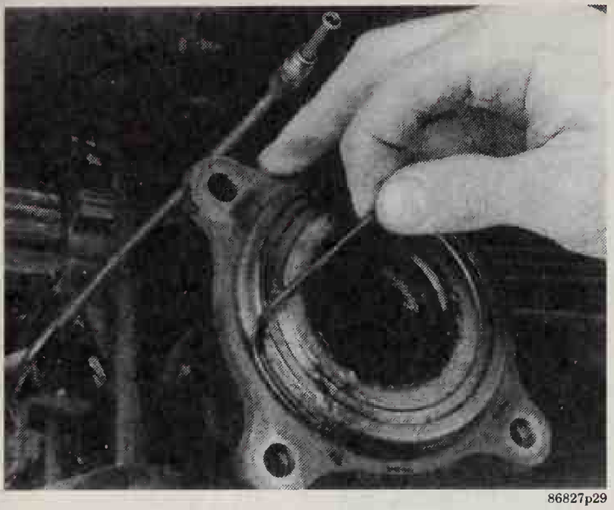


Fig. 145 Pull the O-ring from the outside of the housing

4. Remove the brake drum securing screw, then the drum.

CAUTION

Brake pads and shoes may contain asbestos which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

5. Remove the brake springs and the retracting spring clamp bolt. Remove the lower springs and shoe strut. Remove the brake shoes, screws, and the parking brake lever. Disengage the parking brake cable from the lever and the backing plate.
6. Disconnect the brake line from the wheel cylinder, being careful not to damage the fitting. Plug the brake line.
7. Remove the four nuts retaining the brake backing plate to the axle housing.
8. Remove the snapring and then press the axle shaft out of the backing plate and slide the assembly out of the housing.
9. Remove the oil seal and press out the axle bearing.

To install:

10. Press a new bearing into the brake backing plate and replace the oil seal.
11. Install a new O-ring into the axle housing.
12. Install the axle shaft and brake backing plate assembly into the axle housing. Be careful not to damage the oil seal with the axle splines. Rotate the axle back and forth until the shaft splines mesh with the differential gear splines.
13. Install the brake backing plate nuts and tighten to 51 ft. lbs. (69 Nm) install a new snapring.
14. Install the brake shoes and lever assembly. Connect the parking brake cable and the brake shoe springs.
15. After installing the brake drum, bleed the brakes and adjust the brake shoe clearance.
16. Refill the axle housing with lubricant.

1996 MODELS

➧ **See Figures 147, 148 and 149**

1. Loosen the lug nuts on the rear wheel.
2. Raise and support the vehicle, then remove the wheel.
3. Remove the brake drum.
4. Check the bearing backlash and axle shaft deviation as follows:
   a. Using a dial indicator, check that the backlash in the bearing shaft direction. The maximum is 0.027 in. (0.7mm).
   b. If the backlash exceeds the maximum, replace the bearing.
   c. Using a dial indicator, check the deviation at the surface of the axle shaft outside the hub bolt. Maximum is 0.0039 in. (0.1mm).
   d. If the deviation exceeds the maximum, replace the axle shaft.
5. On models with ABS, remove the ABS speed sensor from the axle housing.
6. Remove the axle shaft assembly by unfastening the 4 nuts from the backing plate. Pull out the shaft assembly from the rear axle housing.
7. Remove the O-ring from the axle housing.
8. On ABS models, remove the bearing and retainer (differential side) and ABS speed sensor rotor.
9. Remove the snapring from the axle shaft.
10. Remove the rear axle shaft from the backing plate. Inspect the axle shaft run-out. Shaft run-out should be 0.079 in. (2.0mm) and the flange run-out should be 0.004 in. (0.1mm).
11. Remove the outer seal. Using a suitable bearing removal tool, separate the bearing from the axle shaft.

To install:

12. Install a new bearing to the axle shaft.
13. Install a new outer seal onto the axle shaft.
14. Replace the inner side oil seal.
15. Apply multi-purpose grease to the oil seal lip. Press the axle shaft into the backing plate. Install a new snapring.
16. On ABS models, install the ABS speed sensor rotor and bearing retainer on the differential side.
17. Attach a new O-ring on the axle housing.
18. Install the axle assembly attach the 4 mounting bolts to the backing plate. Tighten to 48 ft. lbs. (66 Nm).
19. Install the rear brake assembly.
20. On vehicles with ABS, install the sensor to the rear housing assembly, tighten to 71 inch lbs. (8 Nm).
21. Install the rear drum and wheel.
22. Bleed the brake system and check for leaks.
23. Lower the vehicle and test drive.

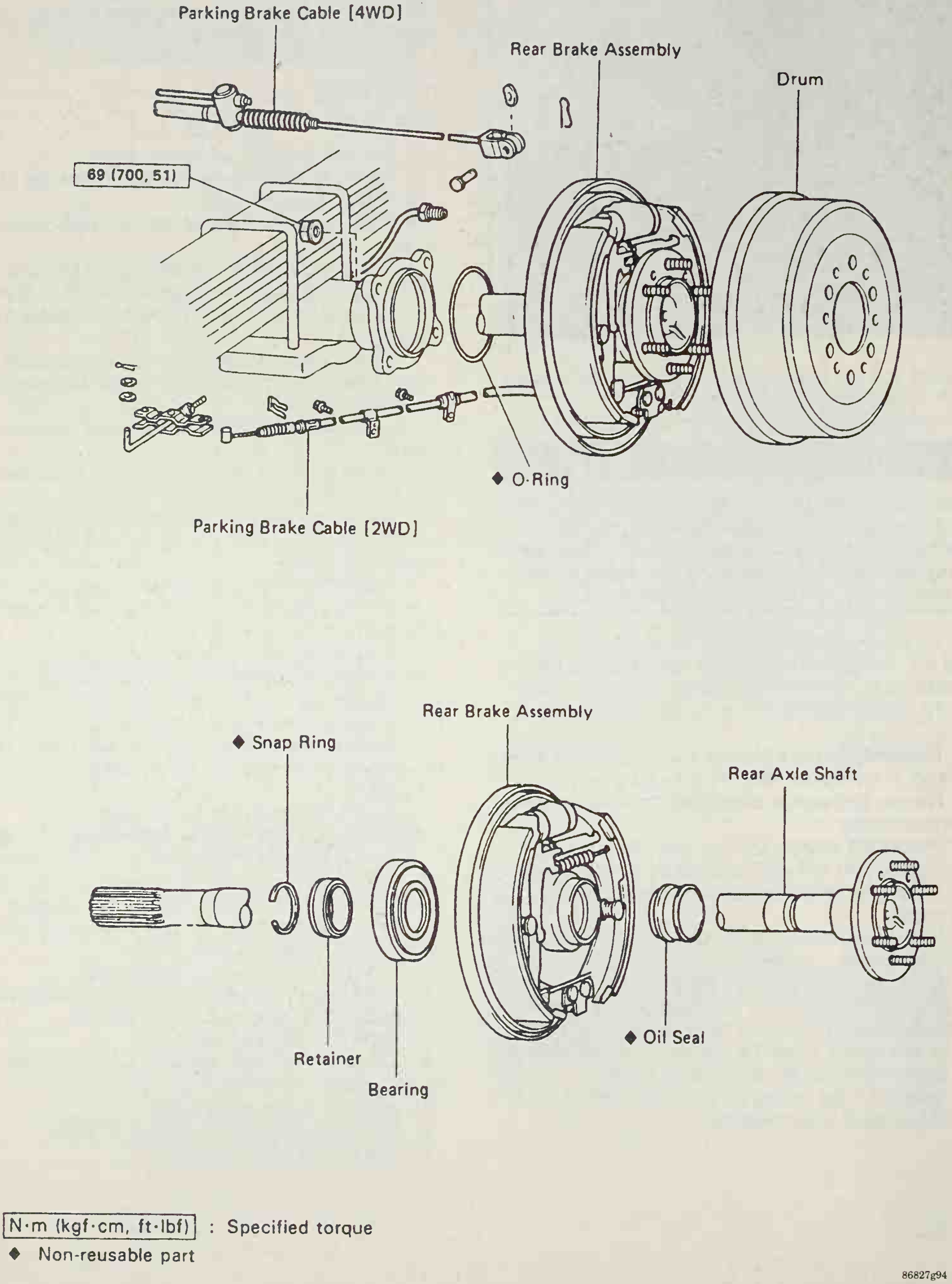

Parking Brake Cable [4WD]
Rear Brake Assembly
Drum
69 (700, 51)
◆ O-Ring
Parking Brake Cable [2WD]
Rear Brake Assembly
◆ Snap Ring
Rear Axle Shaft
◆ Oil Seal
Retainer
Bearing
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g94

Fig. 146 Exploded view of the rear axle shaft and components — 1989-95 Pick-Up and 4Runner

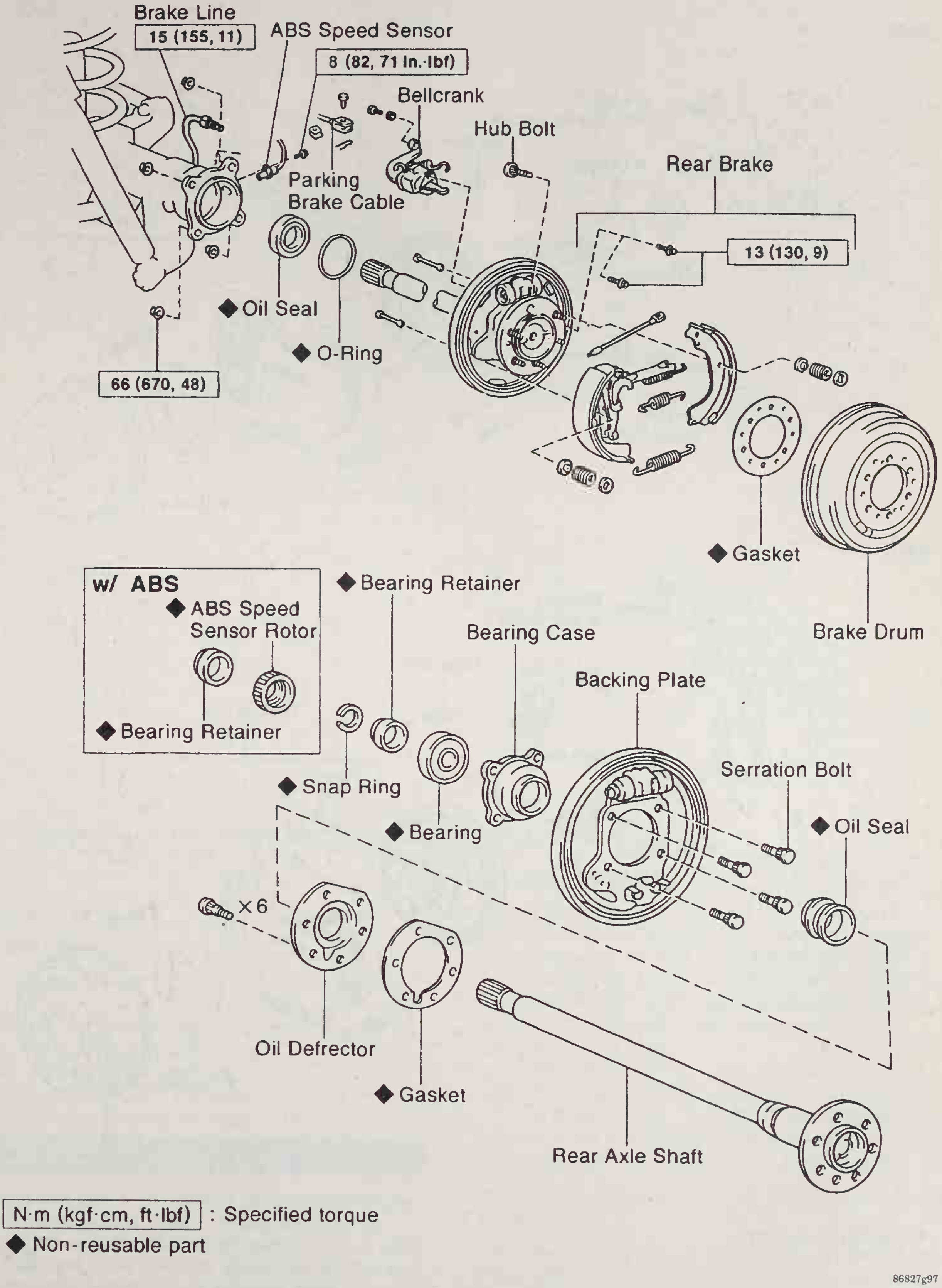

Brake Line
15 (155, 11)
ABS Speed Sensor
8 (82, 71 in.·lbf)
Bellcrank
Hub Bolt
Rear Brake
Parking Brake Cable
13 (130, 9)
◆ Oil Seal
◆ O-Ring
66 (670, 48)
◆ Gasket
Brake Drum
w/ ABS
◆ ABS Speed Sensor Rotor
◆ Bearing Retainer
◆ Bearing Retainer
Bearing Case
Backing Plate
◆ Snap Ring
◆ Bearing
Serration Bolt
◆ Oil Seal
×6
Oil Defrector
◆ Gasket
Rear Axle Shaft
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g97

Fig. 147 Exploded view of the rear axle shaft and components — 1996 4Runner

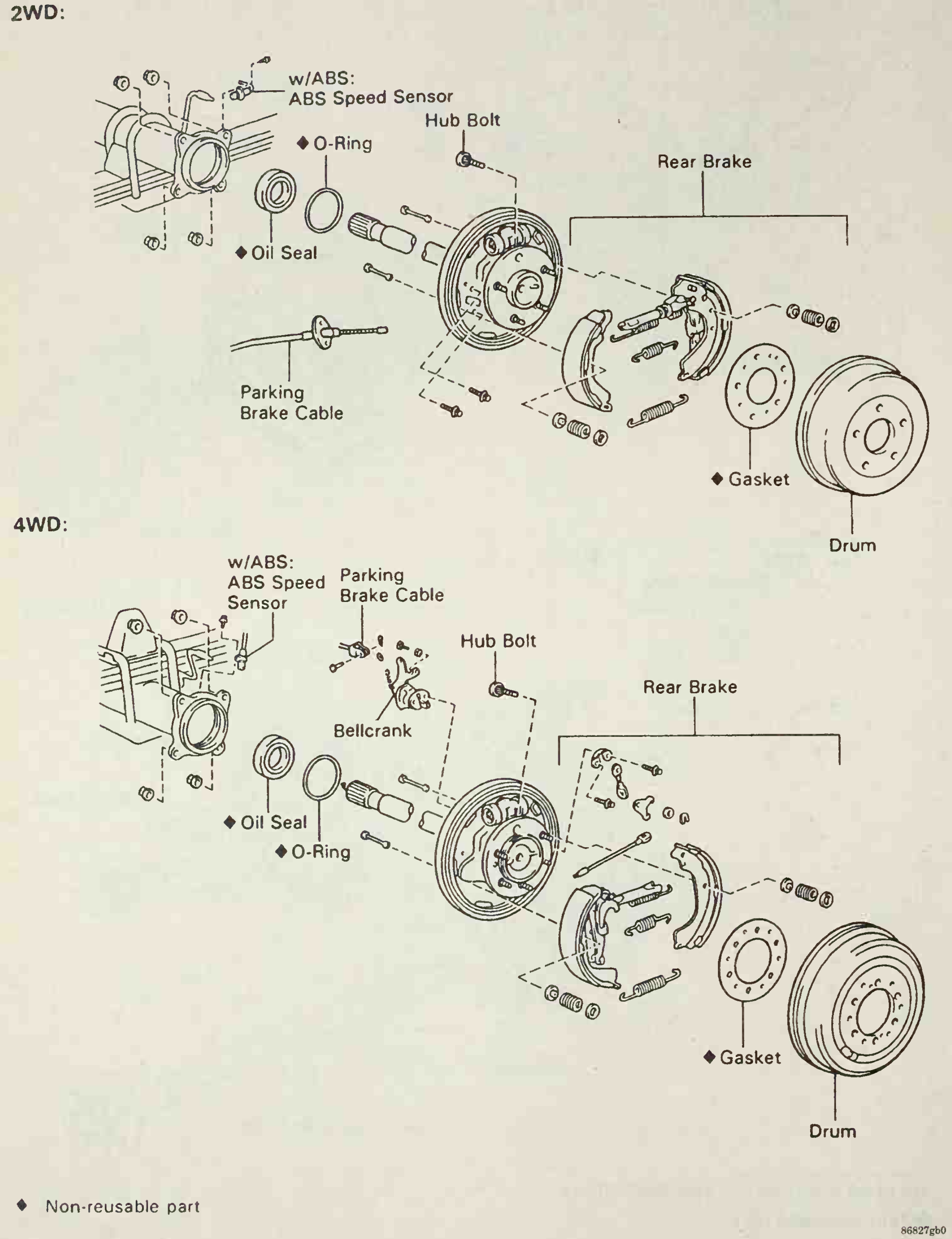

2WD:
w/ABS:
ABS Speed Sensor
Hub Bolt
◆ O-Ring
Rear Brake
◆ Oil Seal
Parking
Brake Cable
◆ Gasket
Drum
4WD:
w/ABS:
ABS Speed
Sensor
Parking
Brake Cable
Hub Bolt
Rear Brake
Bellcrank
◆ Oil Seal
◆ O-Ring
◆ Gasket
Drum
◆ Non-reusable part
86827gb0

Fig. 148 Exploded view of the rear axle shaft and components — 1996 Tacoma

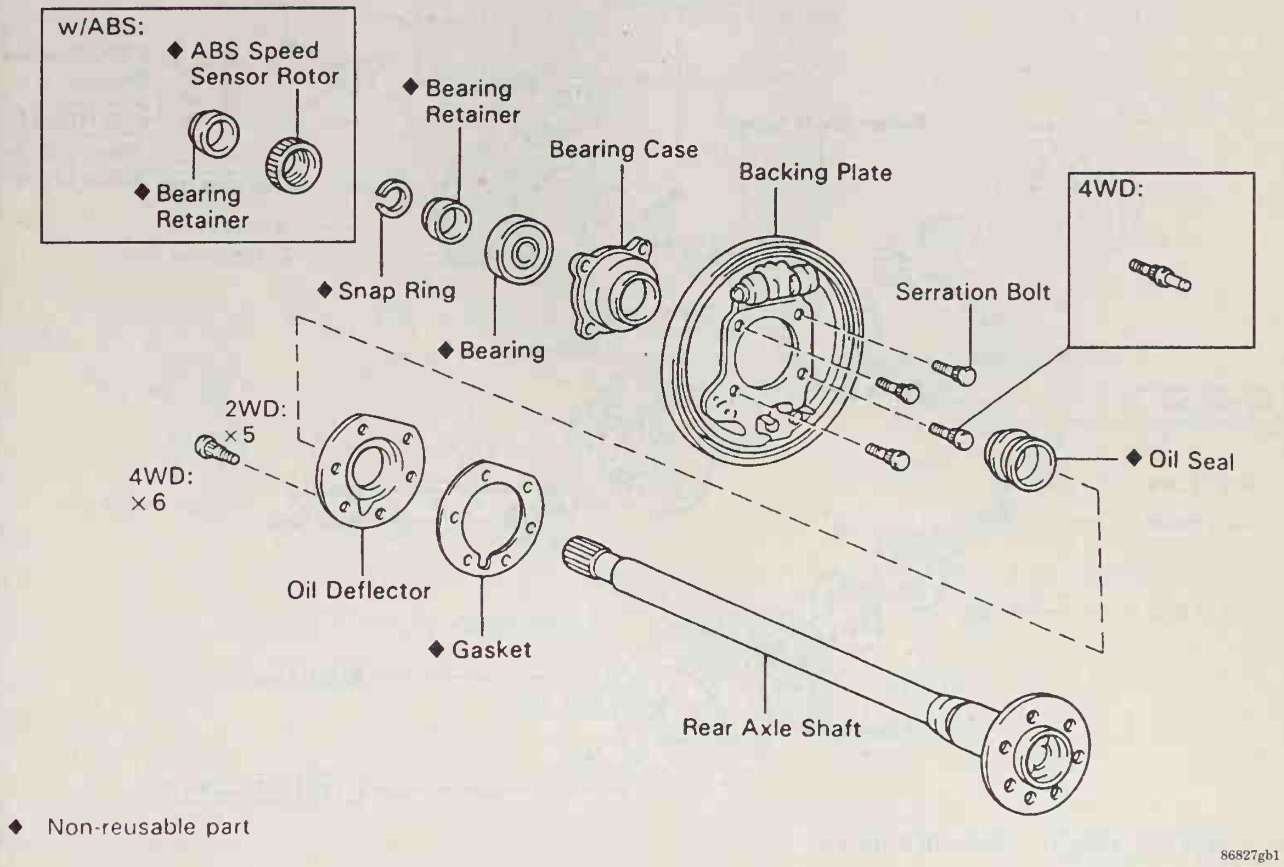

w/ABS:
◆ ABS Speed Sensor Rotor
◆ Bearing Retainer
◆ Bearing Retainer
Bearing Case
Backing Plate
4WD:
◆ Snap Ring
Serration Bolt
◆ Bearing
2WD: ×5
4WD: ×6
◆ Oil Seal
Oil Deflector
◆ Gasket
Rear Axle Shaft
◆ Non-reusable part
86827gb1

Fig. 149 Exploded view of the rear axle shaft and components — 1996 Tacoma (continued)

Land Cruiser

WITH DRUM BRAKES

➧ **See Figure 150**

1. Remove the wheel cover, if any, and loosen the wheel nuts.
2. Raise the rear axle housing with a jack and support the rear of the vehicle with jackstands.
3. Drain the oil from the differential.
4. Remove the wheel nuts and take off the wheels.
5. Remove the brake drum and related parts.

⁂CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

6. On some models it will be necessary to remove the load sensing proportioning valve bracket from the rear cover. Remove the cover from the back of the differential housing.
7. Remove the pin from the differential pinion shaft.
8. Withdraw the pinion shaft and its spacer from the case.
9. Press the rear shaft toward the differential, to aid in the removal of the axle shaft C-clip or axle shaft lock.
10. Remove the C-clip.
11. Withdraw the axle shaft from the housing.
12. Repeat the removal procedure for the opposite side.
13. To remove oil seal and bearing, use a bearing puller and remove the axle bearing and oil seal together. To replace, use a metal tube to drive bearing and seal into seat.

➡**Do not mix the parts of the left and the right axle shaft assemblies.**

14. After installing the axle shaft, C-lock, spacer and pinion shaft, measure the clearance between the axle shaft and the pinion shaft spacer with a feeler gauge. The clearance should be no more than 0.0181 in. (5mm). If the clearance is not

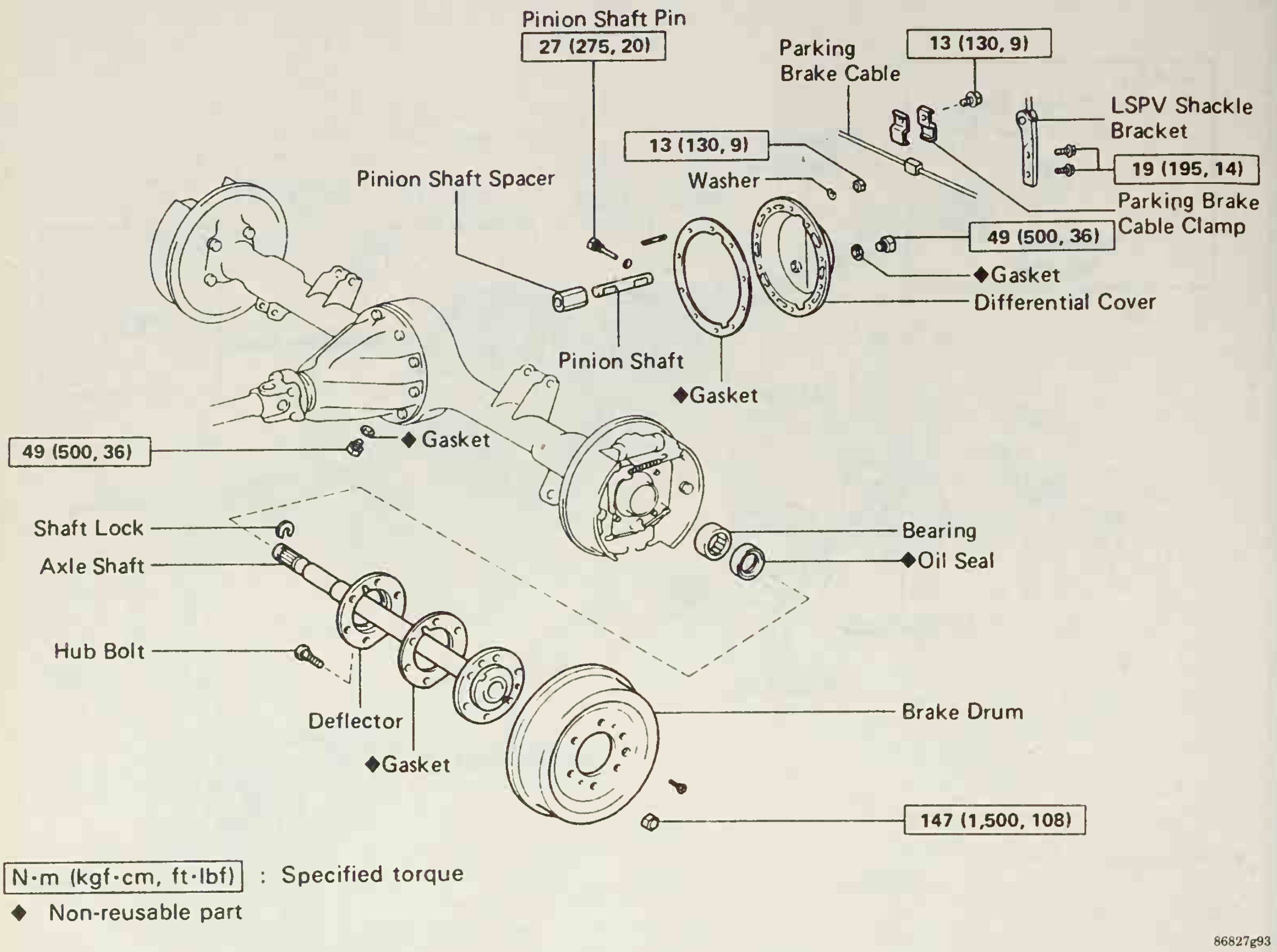

Pinion Shaft Pin
27 (275, 20)
Parking Brake Cable
13 (130, 9)
LSPV Shackle Bracket
13 (130, 9)
19 (195, 14)
Washer
Pinion Shaft Spacer
Parking Brake Cable Clamp
49 (500, 36)
◆Gasket
Differential Cover
Pinion Shaft
◆Gasket
49 (500, 36)
◆ Gasket
Shaft Lock
Axle Shaft
Bearing
◆Oil Seal
Hub Bolt
Deflector
◆Gasket
Brake Drum
147 (1,500, 108)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827g93

Fig. 150 Exploded view of the rear axle shaft and components — Land Cruiser with drum brakes

within specifications, the following spacers are available to adjust it;

- 1.142 in. (29.00mm)
- 1.157 in. (29.39mm)
- 1.173 in. (29.80mm)
- 1.189 in. (30.20mm)
- 1..205 in. (30.60mm)

15. Fill the axle with the proper lubricant.

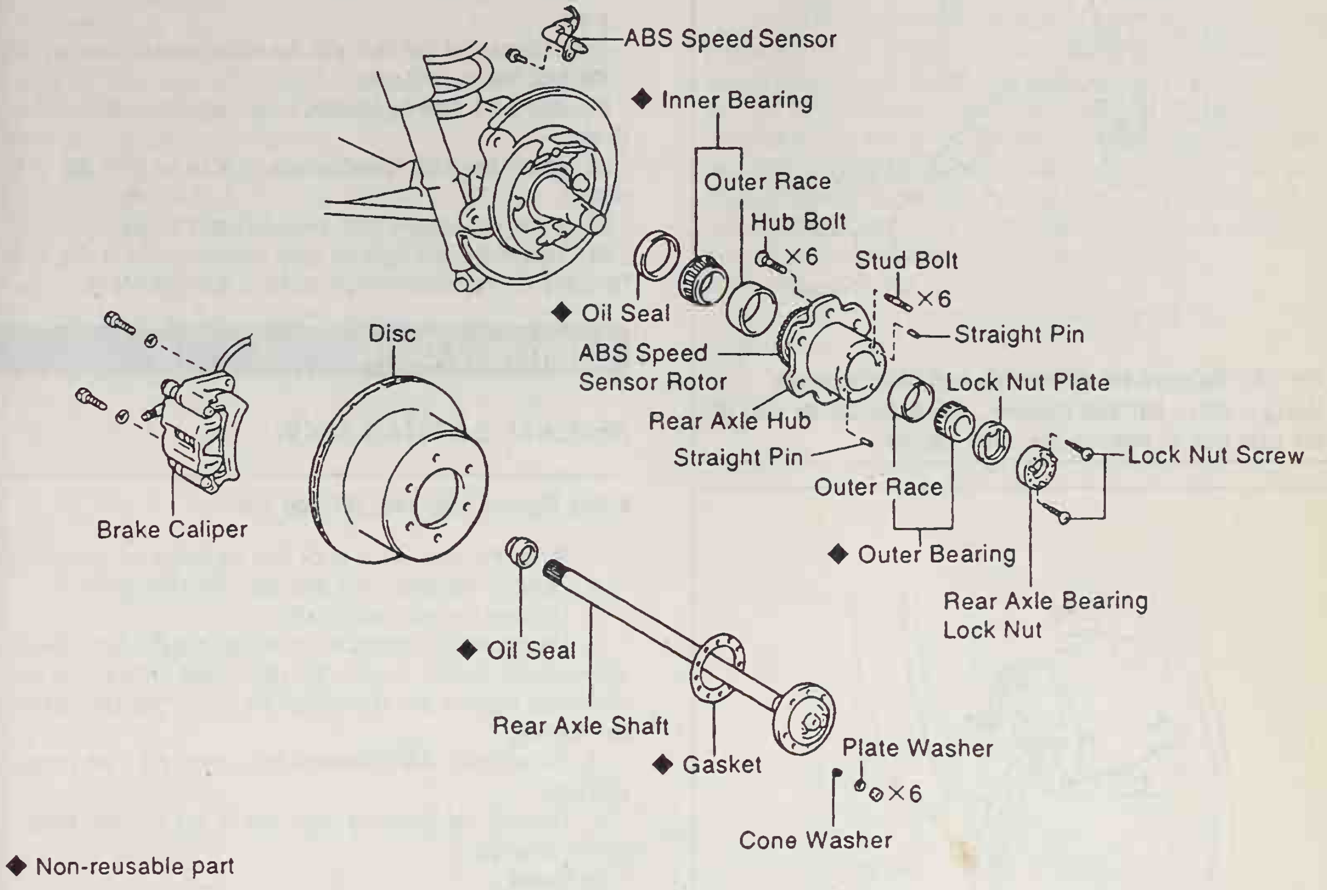
WITH DISC BRAKES

➧ **See Figures 151, 152, 153 and 154**

1. Loosen the lug nuts on the rear wheel. Raise and support the vehicle.
2. Remove the wheel.
3. Remove the 6 nuts and plate washers. Using a brass bar and hammer, strike the center part of the axle shaft to remove the cone washers.
4. Install 2 bolts into the axle holes. Gradually tighten the bolts evenly, then pull the axle shaft. Remove the bolts from the shaft. Remove the shaft and discard the gasket.
5. Remove the brake caliper and rotor.
6. Disconnect the ABS speed sensor.
7. Remove the two mounting screws from the rear axle bearing locknut. Remove the locknut, a SST 09509-25011 or an equivalent socket may be used.
8. Pull out the rear axle hub, locknut plate and outer bearing. Remove the axle hub.
9. Once the hub is removed, with a seal puller, remove the oil seal and inner bearing from the unit.
10. Using a brass bar and hammer, tap out the outer bearing races.

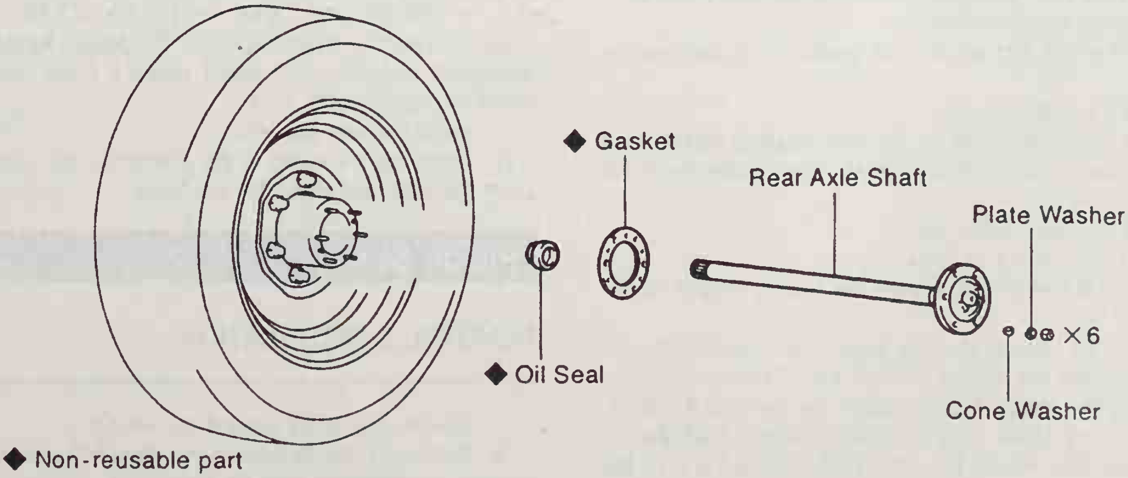
To install:

11. Using a special tool and a press, install the new outer races.
12. Pack multi-purpose grease into the bearing until it oozes out from the other side.
13. Coat the inside of the hub with grease.
14. Install the inner bearing and oil seal as follows:
    a. Place the inner bearing into the hub.
    b. Tap the seal into place with the seal installer.
    c. Apply multi-purpose grease to the oil seal lip.


ABS Speed Sensor
◆ Inner Bearing
Outer Race
Hub Bolt
×6
Stud Bolt
×6
◆ Oil Seal
Straight Pin
Disc
ABS Speed Sensor Rotor
Lock Nut Plate
Rear Axle Hub
Straight Pin
Lock Nut Screw
Outer Race
Brake Caliper
◆ Outer Bearing
Rear Axle Bearing Lock Nut
◆ Oil Seal
Rear Axle Shaft
Plate Washer
◆ Gasket
×6
Cone Washer
◆ Non-reusable part

86827g89

Fig. 151 Exploded view of the rear axle hub and components — Land Cruiser with disc brakes


◆ Gasket
Rear Axle Shaft
Plate Washer
×6
◆ Oil Seal
Cone Washer
◆ Non-reusable part

86827g90

Fig. 152 Exploded view of the rear axle shaft and components — Land Cruiser with disc brakes

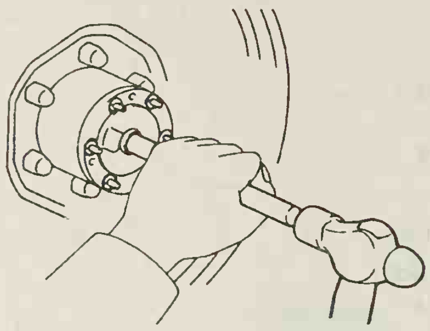


Fig. 153 Remove the 6 set nuts and plate washers. Using a brass bar and hammer, strike the center part of the axle hub to remove the cone washers

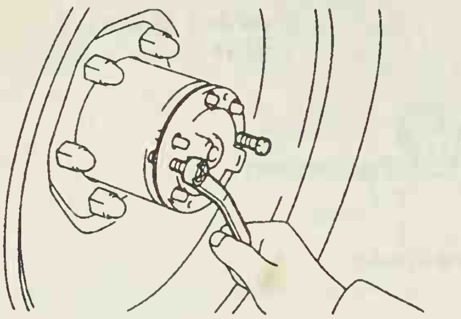


Fig. 154 Install 2 bolts 180° apart into the axle holes

15. Clean the hub installation position of the axle housing and apply clean lubricant (thinly).
16. Place the hub into position Be careful not to damage the axle seal.
17. Install the outer bearing.
18. Place the locknut plate on the axle housing, making sure the tongue lines up with the key groove. Temporarily install the locknut.
19. Install the rotor to the hub.
20. Adjust the preload as follows:
    a. Use a torque wrench tighten the bearing locknut to 43 ft. lbs. (59 Nm).
    b. Make the bearing snug by turning the hub several times. Retighten the locknut to 43 ft. lbs. (59 Nm).
    c. Using the torque wrench, loosen the nut until it can be turned by hand. Using a spring tension gauge, check that the preload, then tighten the nut until the preload is 6-13 lbs. (26-57 N).
    d. Align the mark on the bearing locknut and tip of the axle housing under the above preload range.
    e. Check the distance between the top surface of the axle housing and the locknut. It should be 0.0079-0.0354 in. (0.2-0.9mm) below the surface of the axle housing. If the distance is greater than specified, reassemble the locknut plate.
    f. Check that the hub with the rotor rotates smoothly and the hub has no axle play.
21. Install the bearing locknut screw, tighten to 48 inch lbs. (5 Nm).
22. Attach the ABS speed sensor, tighten to 13 ft. lbs. (18 Nm).
23. Install the caliper, rear axle shaft and wheel.
24. Tighten the lug nuts on steel wheels to 109 ft. lbs. (147 Nm) and on aluminum wheels to 76 ft. lbs. (103 Nm).

Differential Carrier

REMOVAL & INSTALLATION

➧ See Figures 155, 156, 157 and 158

1. Raise the rear of the truck and support it on jackstands.
2. Remove the drain plug and drain the differential oil.
3. Remove the rear axle shafts.
4. Disconnect the driveshaft at the differential. On vehicles with anti-lock brakes, remove the rear speed sensor from the differential housing and disconnect the wiring harness clip from the housing.
5. On vehicles with differential lock, disconnect the harness and tube.
6. Remove the mounting bolts and lift out the differential carrier assembly.

To install:

7. Install a new gasket and position the carrier assembly into the axle housing. Tighten the mounting bolts to:
    - Pick-Up, 4Runner, Tacoma and T100 with differential lock — 18 ft. lbs. (25 Nm)
    - Pick-Up, 4Runner, Tacoma and T100 without differential lock — 54 ft. lbs. (73 Nm)
    - 1989-91 Land Cruiser — 34 ft. lbs. (47 Nm)
    - 1992-96 Land Cruiser — 54 ft. lbs. (73 Nm)
8. Connect the driveshaft to the companion flange on the differential. Install the rear speed sensor if it was removed; install the wire harness clips.
9. Install the rear axle shafts.
10. Lower the truck and fill the differential with gear oil. Drive the truck and check for any leaks.

Pinion Seal

REMOVAL & INSTALLATION

1. Elevate and safely support the vehicle.
2. Matchmark the flanges on the driveshaft and pinion. Disconnect the driveshaft from the differential.
3. Use a hammer and small chisel to loosen the staking on the companion flange bolt. Attach a counterholding tool to the

companion flange and remove the nut. Use the proper threaded extractor to remove the companion flange.

4. Use an extractor to remove the oil seal and oil slinger from the housing.

To install:

5. Make certain the new seal faces in the correct direction. Install the new seal with a driver or seal installation tool of the correct diameter. Drive the new seal in until it is recessed 0.039 in. (1.0mm) in the housing.

6. Coat the inner lip of the seal with multi-purpose grease. Install the companion flange (and washer, if removed). Apply a light coat of oil to the threads of a NEW companion flange nut.

7. Set up the counterholding tool and install the companion flange nut. For Pick-Ups, 4Runners, T100s tighten it to 145 ft. lbs. (196 Nm). On Land Cruisers, tighten to 181 ft. lbs. (245 Nm). On Tacoma tighten to 109 ft. lbs. (147 Nm).

8. Check the drive pinion preload with a torque wrench. For Pick-Ups and 4Runners, correct torque is 8-11 inch lbs. (0.9-1.2 Nm) for 2-spider gear differentials and 4-7 inch lbs. (0.4-0.8 Nm) for 4-spider gear units. Land Cruisers should be between 6-9 inch lbs. (0.6-1.0 Nm).

9. If the preload is greater than specified, the bearing spacer must be removed and replaced inside the pinion housing. Do NOT back off the companion flange nut to relieve the pressure. If the preload is less than specified (the usual case), retighten the companion flange nut in increments of 9 ft. lbs. (13 Nm) until the correct specification is reached. Maximum allowable torque on the nut under any condition is 325 ft. lbs. (441 Nm) on Land Cruiser and Tacoma, 253 ft. lbs. (343 Nm) on Pick-Ups and 4Runner, and 109 ft. lbs. 333 ft. lbs. (451 Nm) on T100. Take great care not to exceed either the preload limit or the maximum torque on the nut.

10. Stake the drive pinion nut.

11. Connect the rear propeller shaft, aligning the matchmarks.

12. Lower the vehicle to the ground; inspect the fluid level in the axle.

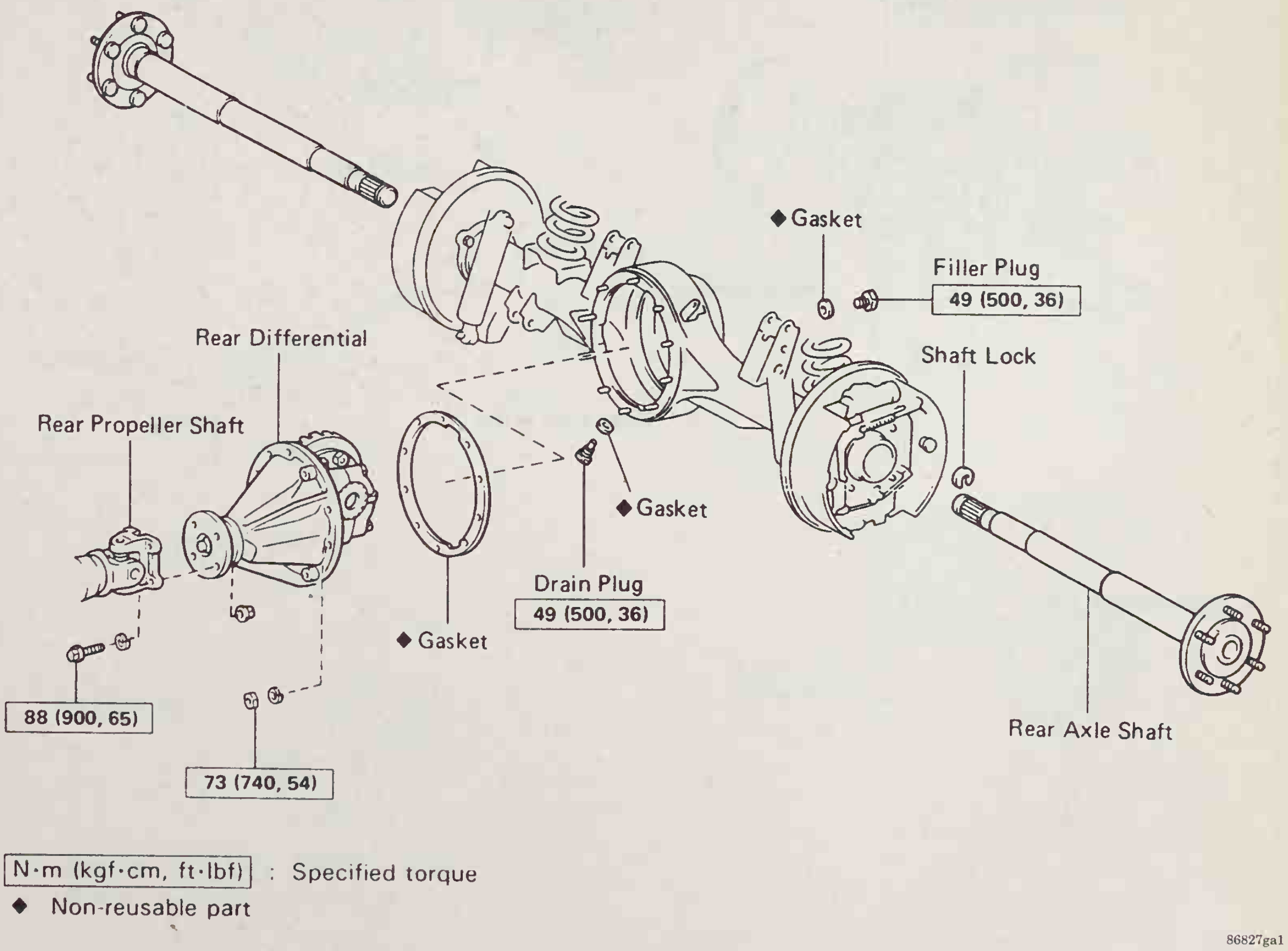


Fig. 155 Exploded view of the rear differential — 1992 Land Cruiser shown

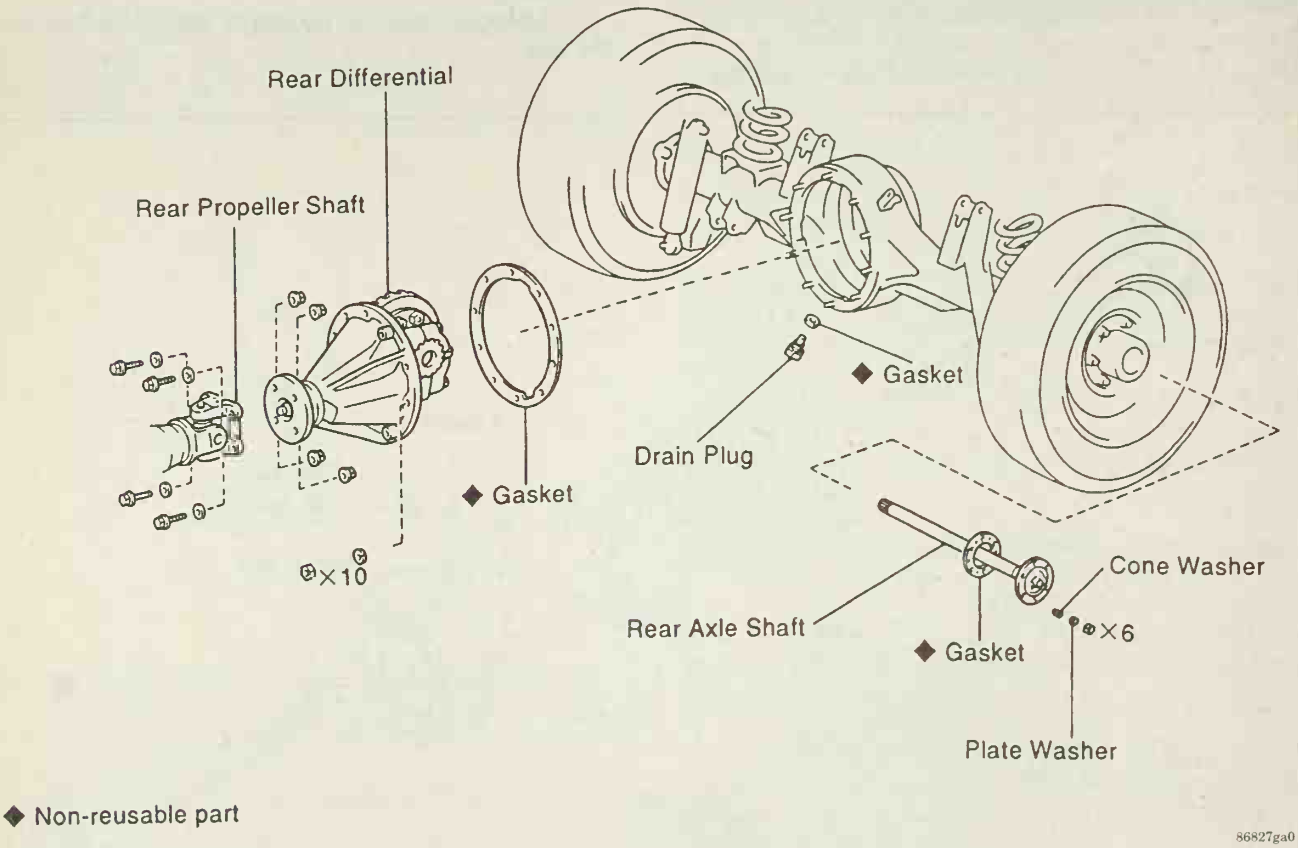

Rear Differential
Rear Propeller Shaft
×10
◆ Gasket
Drain Plug
◆ Gasket
Cone Washer
Rear Axle Shaft
×6
◆ Gasket
Plate Washer
◆ Non-reusable part
86827ga0

Fig. 156 Exploded view of the rear differential — 1996 Land Cruiser shown

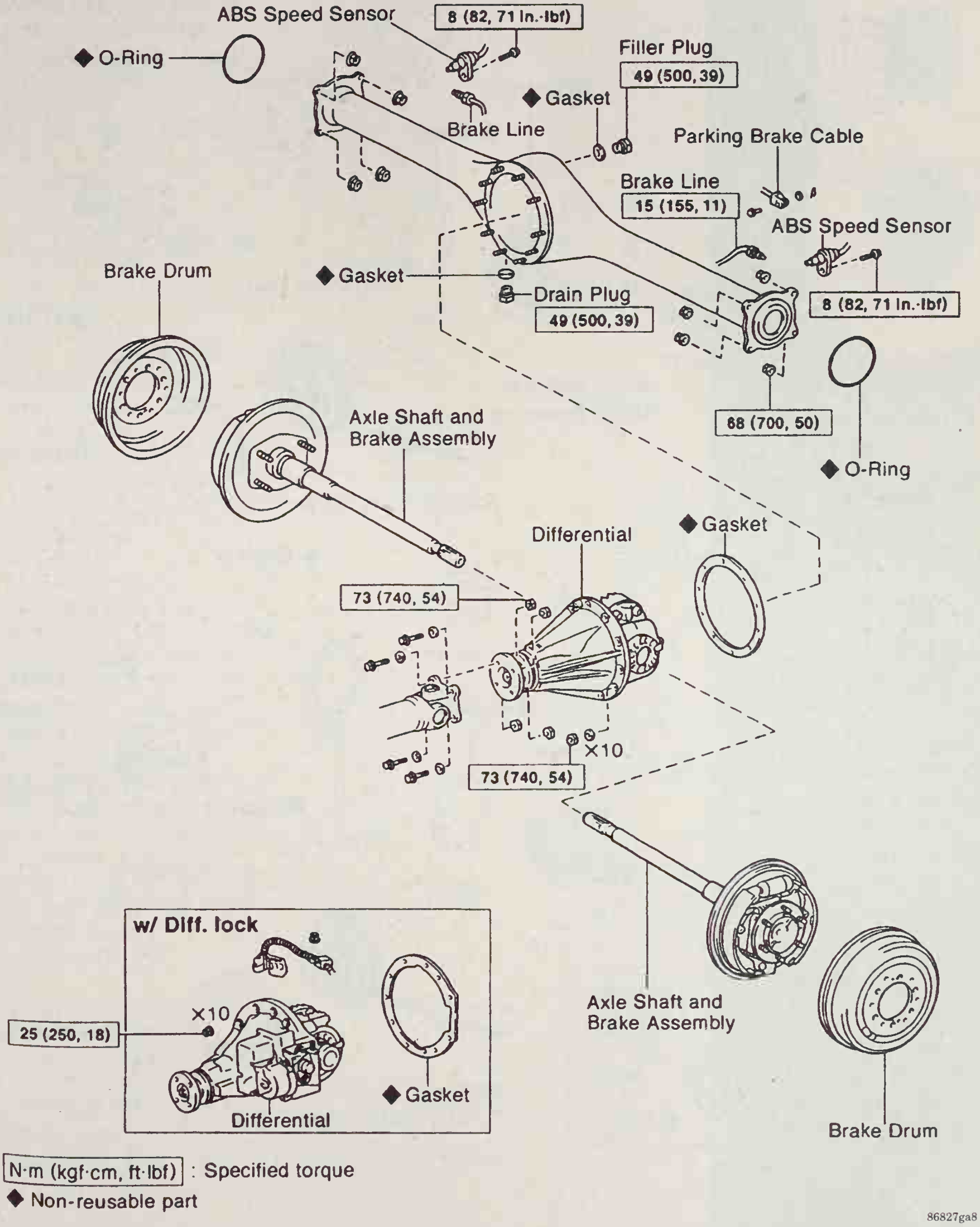

ABS Speed Sensor
8 (82, 71 In.-lbf)
◆ O-Ring
Filler Plug
49 (500, 39)
◆ Gasket
Brake Line
Parking Brake Cable
Brake Line
15 (155, 11)
ABS Speed Sensor
Brake Drum
◆ Gasket
Drain Plug
49 (500, 39)
8 (82, 71 In.-lbf)
68 (700, 50)
◆ O-Ring
Axle Shaft and Brake Assembly
Differential
◆ Gasket
73 (740, 54)
×10
73 (740, 54)
w/ Diff. lock
×10
25 (250, 18)
◆ Gasket
Differential
Axle Shaft and Brake Assembly
Brake Drum
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86827ga8

Fig. 157 Exploded view of the rear differential — 1996 4Runner shown

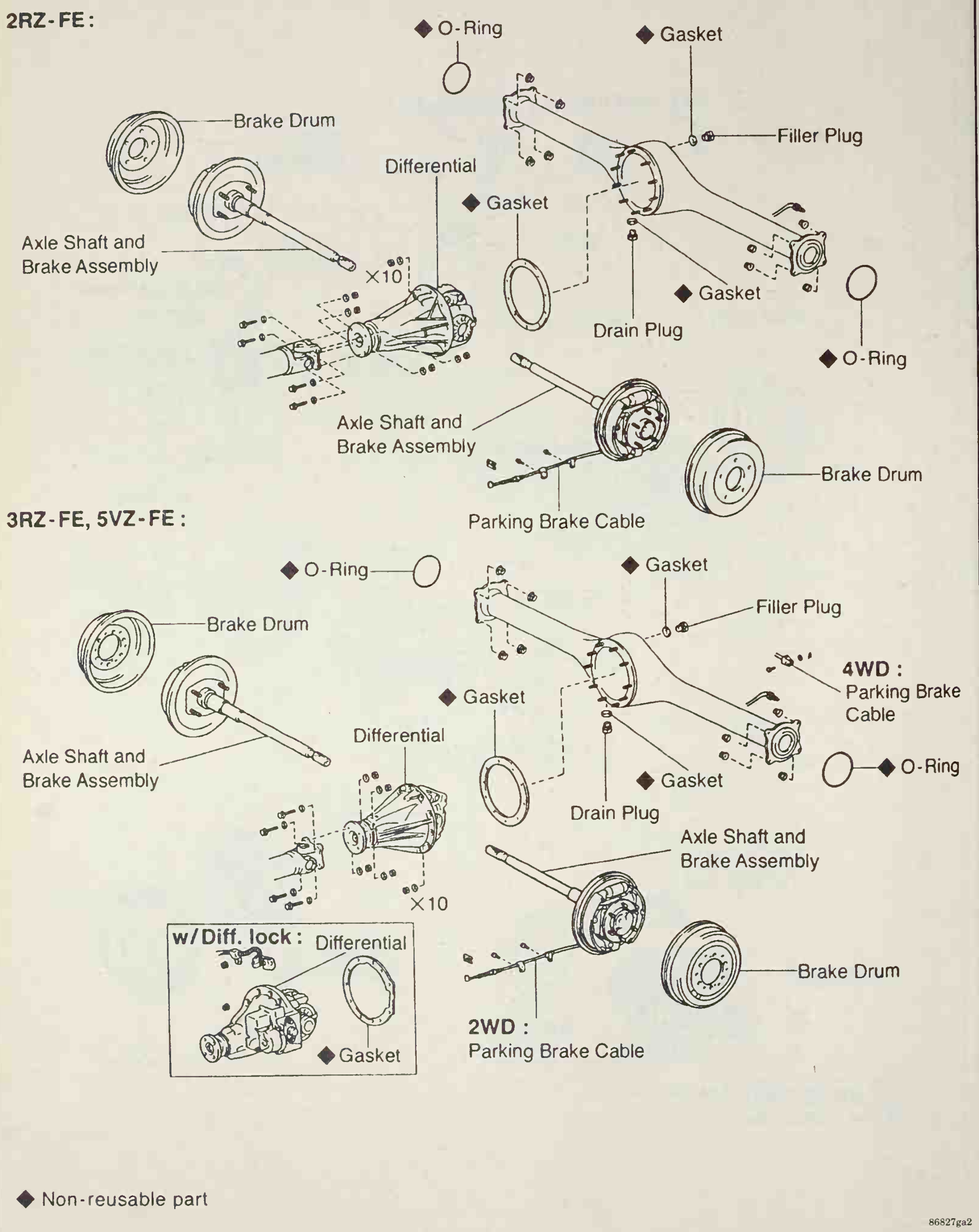

2RZ-FE:
◆ O-Ring
◆ Gasket
Brake Drum
Filler Plug
Differential
◆ Gasket
Axle Shaft and Brake Assembly
×10
◆ Gasket
Drain Plug
◆ O-Ring
Axle Shaft and Brake Assembly
Brake Drum
Parking Brake Cable
3RZ-FE, 5VZ-FE :
◆ O-Ring
◆ Gasket
Filler Plug
Brake Drum
4WD :
Parking Brake Cable
◆ Gasket
Differential
Axle Shaft and Brake Assembly
◆ O-Ring
◆ Gasket
Drain Plug
Axle Shaft and Brake Assembly
×10
w/Diff. lock :
Differential
◆ Gasket
Brake Drum
2WD :
Parking Brake Cable
◆ Non-reusable part
86827ga2

Fig. 158 Exploded view of the rear differential — Tacoma

8

SUSPENSION AND STEERING

2WD FRONT SUSPENSION 8-3
2WD REAR SUSPENSION 8-39
4WD FRONT SUSPENSION 8-22
4WD REAR SUSPENSION 8-42
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2WD FRONT SUSPENSION
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- LOWER CONTROL ARM 8-16
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2WD REAR SUSPENSION
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4WD FRONT SUSPENSION
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- FRONT AXLE HUB AND BEARING 8-38
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- LEADING ARM 8-33
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- LOWER BALL JOINT 8-26
- LOWER CONTROL ARM 8-31
- SHOCK ABSORBERS 8-23
- STABILIZER BAR (SWAY BAR) 8-28
- STEERING KNUCKLE AND SPINDLE 8-33
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- UPPER CONTROL ARM 8-30

4WD REAR SUSPENSION
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WHEELS
- WHEEL LUG STUDS 8-2
- WHEELS 8-2

WHEELS

Wheels

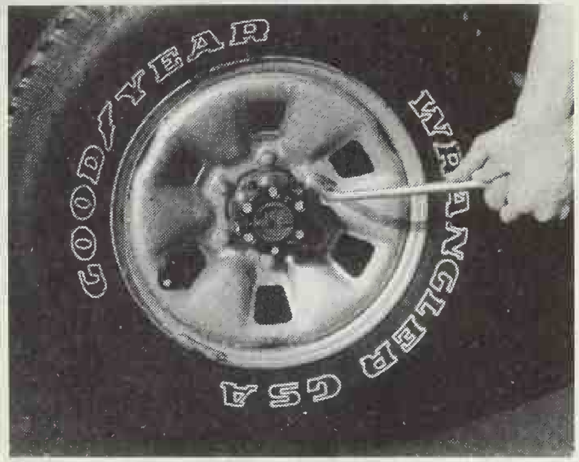
REMOVAL & INSTALLATION

➧ **See Figures 1 and 2**

1. Apply the parking brake and block the opposite wheel.
2. If equipped with an automatic transmission, place the selector lever in **P**. For manual transmission models, place the shifter in Reverse.
3. If equipped, remove the wheel cover or hub cap.
4. Break loose the lug nuts. If a nut is stuck, never use heat to loosen it or damage to the wheel and bearings may occur. If the nuts are seized, one or two heavy hammer blows directly on the end of the bolt head usually loosens the rust. Be careful as continued pounding will likely damage the brake drum or rotor.
5. Raise the vehicle until the tire is clear of the ground. Support the vehicle safely using jackstands.
6. Remove the lug nuts and the tire and wheel assembly.

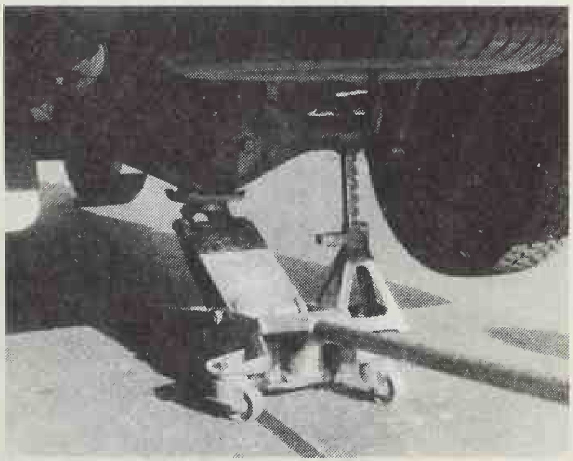
To install:

7. Make sure the wheel and hub mating surfaces as well as the wheel lug studs are clean and free of all foreign material. Always remove rust from the wheel mounting surfaces and the brake rotors/drums. Failure to do so may cause the lug nuts to loosen in service.
8. Position the wheel on the hub or drum and hand-tighten the lug nuts. Tighten all the lug nuts, in a crisscross pattern, until they are snug.
9. Remove the supports, if any, and lower the vehicle. Tighten the lug nuts, in a crisscross pattern. Always use a torque wrench to achieve the proper lug nut torque and to prevent stretching the wheel studs.
10. Repeat the torque pattern to assure proper wheel tightening.
11. If equipped, install the hub cab or wheel cover.



86828p01

Fig. 1 While the vehicle is still on the ground, break loose the lug nuts



86828p02

Fig. 2 Once all of the lug nuts are loosened, raise and safely support the vehicle

INSPECTION

Check the wheels for any damage. They must be replaced if they are bent, dented, heavily rusted, have elongated bolt holes, or have excessive lateral or radial run-out. Wheels with excessive run-out may cause a high-speed vehicle vibration.

Replacement wheels must be of the same load capacity, diameter, width, offset and mounting configuration as the original wheels. Using the wrong wheels may affect wheel bearing life, ground and tire clearance, or speedometer and odometer calibrations.

Wheel Lug Studs

REPLACEMENT

Front

1. Elevate and safely support the vehicle.
2. Remove the wheel.
3. Disconnect the brake line from the front caliper, and plug the line immediately.
4. Remove the brake caliper.

⁂CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

5. For vehicles with free-wheeling hubs, remove the hub. For all other vehicles, remove the cap from the flange and

remove the center bolt. On Land Cruisers, remove the snapring.

6. Remove the 6 mounting nuts.
7. Use a brass bar and hammer to tap on the bolt heads and remove the cone washers.
8. On Land Cruisers, pull out the flange. For other vehicles, install and tighten 2 bolts, using them to force the flange loose.
9. Remove the lockwasher from the hub.
10. Remove the locknut and the lockwasher.
11. Remove the adjusting nut.
12. Remove the axle hub with the brake disc attached.

✱✱CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

13. Place matchmarks on the hub and brake disc. The units must be reinstalled in their exact relationship as before.
14. Remove the bolts holding the disc to the hub.
15. Install a lug nut on the lug. Using a brass bar and a press, remove the hub bolt.

To install:

16. Using a brass bar and a press, install the hub bolt. Reverse the disc and using a press install the new lug. Make sure it is firmly and completely seated in the disc.
17. Align the matchmarks and place the hub on the disc. Install the 6 bolts, tightening them to 47 ft. lbs. (64 Nm).
18. Install the disc and hub.
19. Install the brake caliper.
20. Attach the brake line to the caliper.
21. Bleed the brake system.
22. Install the wheel.
23. Lower the vehicle to the ground then tighten the lug nuts.

Rear

1. Elevate and safely support the vehicle.
2. Remove the wheel.
3. Remove the brake drum.

✱✱CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

4. Use a lug extractor such as tool 09650-17011 or equivalent to press out the lug.

➡This can be done with the axle and brakes in place if you're careful.

To install:

5. Fit the new lug into the hole. Place a flat washer over the lug and install a lug nut on the new lug. Use a hand wrench to tighten the nut, drawing the lug into position. Remove the nut when the lug is fully seated.
6. Install the brake drum.
7. Install the wheel.
8. Lower the vehicle to the ground.

2WD FRONT SUSPENSION

After you work on your truck's suspension, it is advisable to have the alignment checked at a reputable repair facility. This will ensure that your front end is in order after repairs.

Coil Spring

REMOVAL & INSTALLATION

Tacoma

◗ See Figure 3

1. Remove the front wheel.
2. Remove the shock absorber.
3. Compress the spring using a spring compressor, see the manufacturer's instructions for the procedure.
4. Disconnect the stabilizer bar as follows:
    a. Remove the nut and stabilizer bar link from the lower control arm.
    b. Remove the 2 stabilizer bar bracket set bolts.
5. Remove the lower control arm and sway bar as follows:
    a. Support the upper control arm and steering knuckle securely.
    b. Support the upper control arm and steering knuckle assembly.
    c. Remove the cotter pin and nut.
    d. Using a ball joint extractor, disconnect the lower ball joint from the lower control arm.
    e. Loosen the lower control arm set bolt and remove the nut.
    f. Loosen the strut bar front set bolt, then remove the nut.
    g. Pull out the bolts and remove the lower control arm along with the strut bar.
6. Remove the coil spring compressor tool and coil.

To install:

7. Place each end of the coil spring and lower control arm seat in contact when applying the coil spring expander.
8. Install the lower control arm and strut bar as follows:
    a. Attach the strut bar front set bolt, tighten to 221 ft. lbs. (300 Nm) make sure the suspension is stabilized prior to tightening the bolt.
    b. Install the lower control arm set bolt and nut, tighten to 148 ft. lbs. (200 Nm). Make sure the suspension is stabilized prior to tightening the bolt.
    c. Install the lower ball joint with a ball joint installer tool. Install the nut and cotter pin. Tighten the nut to 80 ft. lbs. (110 Nm).

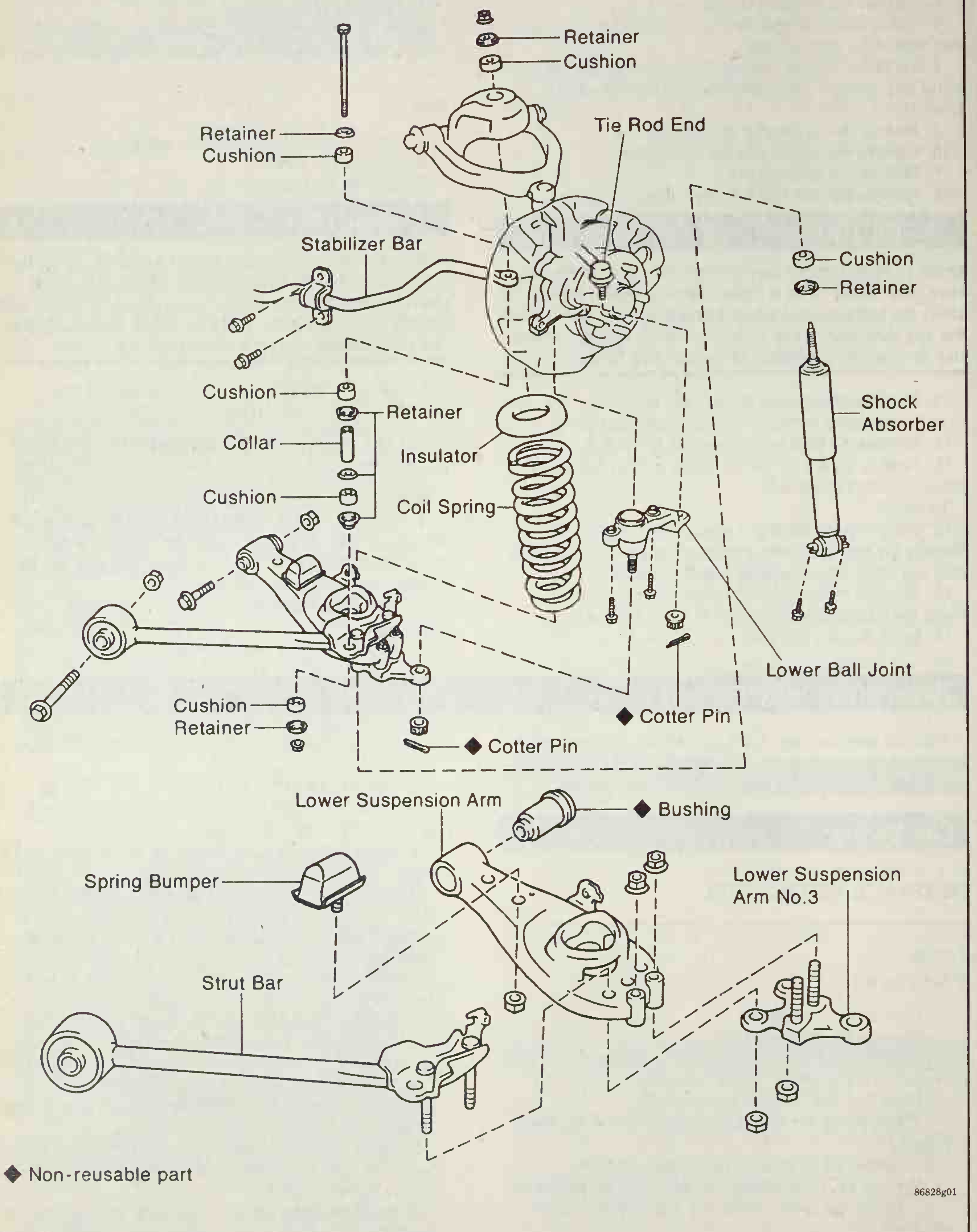

Retainer
Cushion
Tie Rod End
Retainer
Cushion
Stabilizer Bar
Cushion
Retainer
Cushion
Retainer
Collar
Insulator
Cushion
Coil Spring
Shock Absorber
Lower Ball Joint
Cushion
Retainer
◆ Cotter Pin
◆ Cotter Pin
Lower Suspension Arm
◆ Bushing
Spring Bumper
Lower Suspension Arm No.3
Strut Bar
◆ Non-reusable part
86828g01

Fig. 3 Exploded view of the coil spring and related front suspension components — Tacoma

9. Attach the stabilizer bar bracket set bolts, tighten to 22 ft. lbs. (29 Nm).
10. Install the stabilizer link to the lower control arm, tighten to 29 ft. lbs. (39 Nm).
11. Remove the spring compressing tool.
12. Install the shock absorber.
13. Install the wheel, lower the truck and tighten the lug nuts.

Torsion Bars

Torsion bars are used in place of coil springs on Pick-Ups and 4Runners. While employing the same torsional principal as a spring, the torsion bars are installed parallel to the ground instead of vertically as is a coil spring. This allows a much more compact suspension arrangement, lower front end styling and better suspension control since the torsion bar need not move through the greater distances traversed by a compression spring. The torsion bars are under tension as is any installed spring and great care must be taken when removing the bars.

REMOVAL & INSTALLATION

➧ See Figures 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15

✱✱WARNING

Great care must be taken to make sure torsion bars are not mixed after removal, it is strongly suggested that before removal; each be marked with paint, showing the front and rear of spring and from which side of the truck it was taken. If they are installed backward or on the wrong sides of the truck, they could fracture. New units are marked L or R with an arrow showing direction of flex.

1. Raise the truck and support the frame on stands.
2. Slide the boot from the rear of torsion bar spring housing and onto spring.
3. Follow the same procedure on the front of the spring.
4. Paint matchmarks on the torsion bar spring, anchor arm and torque arm.
5. On the rear torsion bar spring holder, there is a long bolt that passes through the arm of the holder and up through the frame crossmember, using a small ruler, measure the length from the bottom of the retaining nut to the threaded tip of the bolt and record this measurement.
6. Loosen the adjusting nut and remove the anchor arm and torsion bar spring.
7. Remove the torque arm, there are tow nuts retaining it.
8. Inspect all parts for wear, damage or cracks. Check the boot for rips and wear. Inspect the splined ends of the torsion bar spring and the splined holes in the rear holder and the front torque arm for damage. Replace as necessary. On the rear end of the torsion bar springs, there are markings to show which is right and which is the left bar. Do not confuse them.
9. To install the existing spring:
   a. Coat the splined ends of the torsion bar with multipurpose grease.
   b. Align the matchmarks and install the torsion bar spring to the torque arm.
   c. Align the matchmarks and install the anchor arm to the torsion bar spring.
   d. Tighten the adjusting nut so that the bolt protrusion measured previously is equal to that of the new adjustment.
10. To install a new torsion bar spring:
   a. Install the 2 bolts to the torsion bar spring.
   b. Lightly coat the spring end splines with grease and then install the anchor arm to the small end of the spring temporarily. Paint matchmarks on the spring and arm.

➡There is one spline on the spring that is larger than the others. When connecting the spring to the arm, turn the arm slowly until you can feel the larger spline match up with the slot in the arm.

   c. Remove the anchor arm from the spring and install the spring into the torque arm.

➡There is one spline on the spring that is larger than the others. When connecting the spring to the arm, turn the arm slowly until you can feel the larger spline match up with the slot in the arm.

   d. Align the matchmarks and install the anchor arm to the spring. Tighten the adjusting nut so that the exposed thread on the bolt is no greater than 87mm.
11. Install the locknut and wheels, lower the truck and bounce it several times to set the suspension.
12. Measure the ground clearance and adjust with the adjusting nut. Tighten the locknut.
13. Have the alignment checked at a reputable repair facility.

Shock Absorbers

REMOVAL & INSTALLATION

➧ See Figures 16, 17, 18, 19, 20 and 21

1. Remove the hubcap and loosen the lug nuts.
2. Raise front of the truck and support it with safety stands.
3. Remove the wheel.
4. Unfasten the double nuts at the top end of the shock absorber. Remove the cushions and cushion retainers.
5. Remove the 2 bolts which secure the lower end of the shock absorber to the lower control arm.
6. Remove the shock absorber.

To install:

7. Place the parts on the shock in the correct order and positions. Retainer, cushion, retainer.
8. Install the shock absorber, then tighten the lower mounting nuts/bolt to 13 ft. lbs. (18 Nm) on all models except the 1996 4Runner. On the 1996 4Runner, tighten to 101 ft. lbs. (135 Nm). Tighten the upper mounting nut to 18 ft. lbs. (25 Nm).
9. Install the wheels and lower the truck.

TESTING

The purpose of the shock absorber is simply to limit the motion of the spring during compression (bump) and rebound cycles. If the vehicle were not equipped with these motion

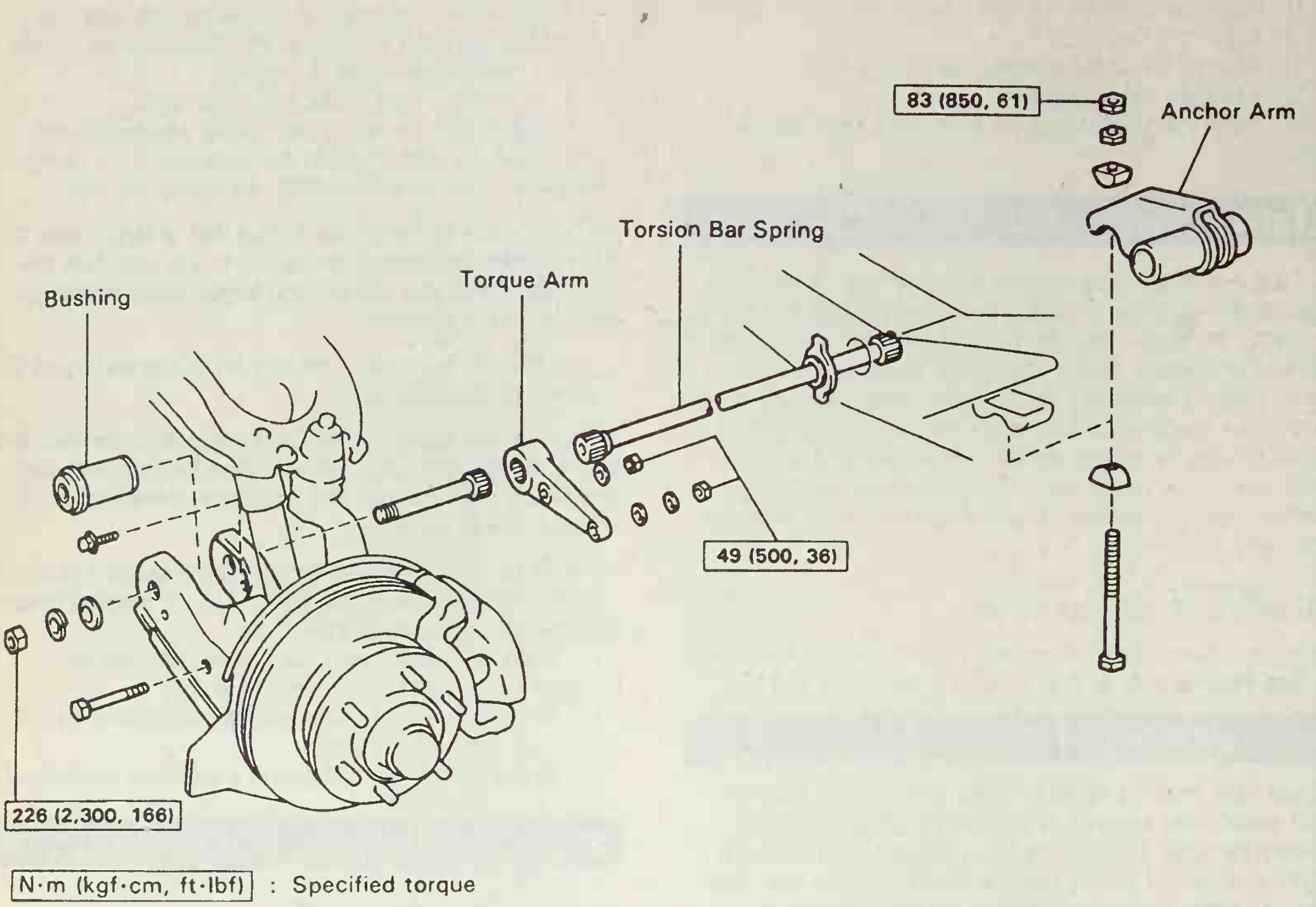

83 (850, 61)
Anchor Arm
Torsion Bar Spring
Torque Arm
Bushing
49 (500, 36)
226 (2,300, 166)
N·m (kgf·cm, ft·lbf) : Specified torque
86828g03

Fig. 4 Exploded view of the torsion bar suspension and associated components

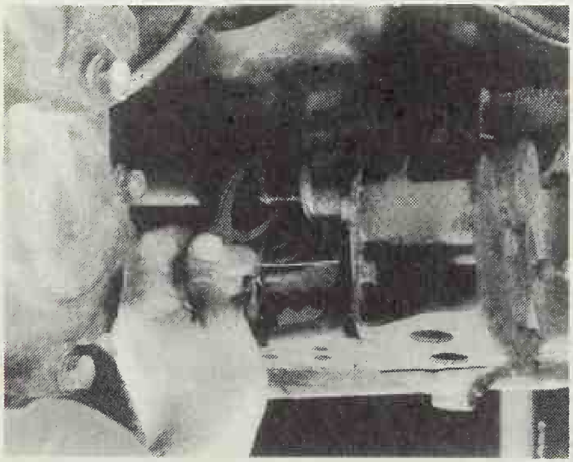


Fig. 5 Slide the boot down the shaft at the rear of the unit

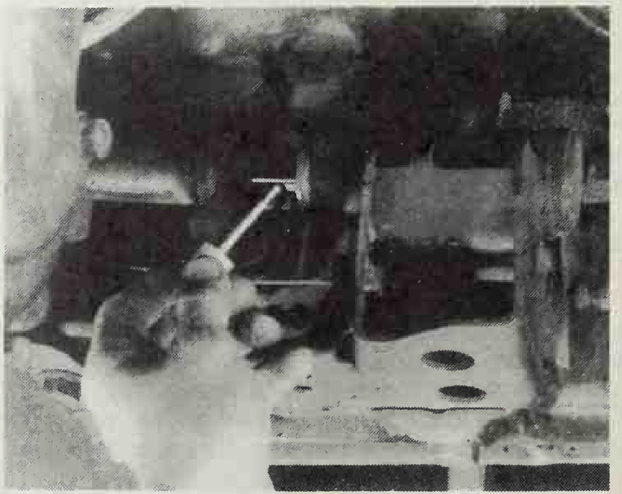
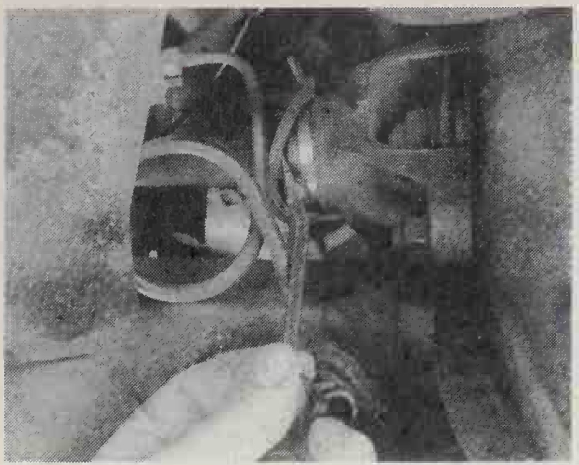
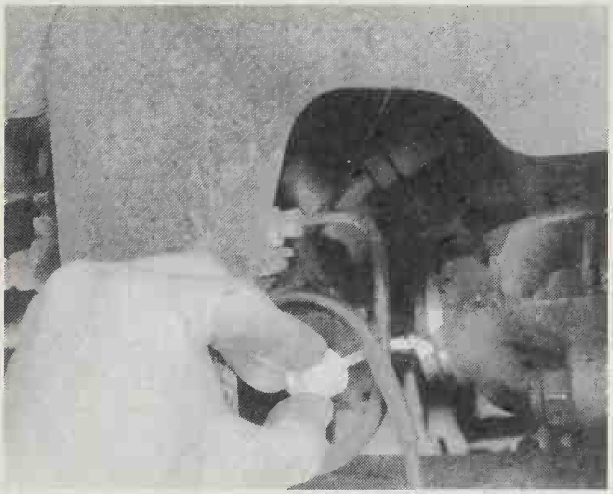


Fig. 6 Matchmark the adjoining components



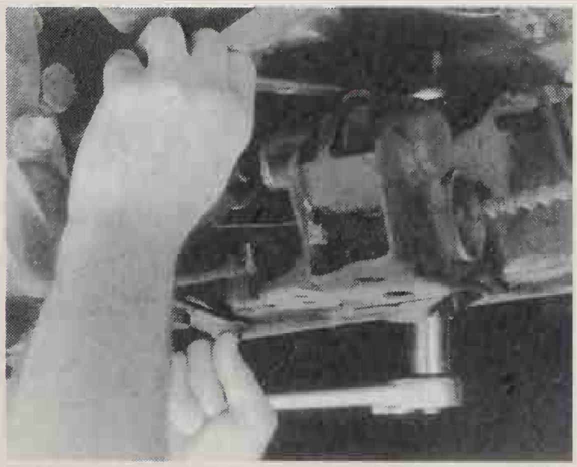
86828g08

Fig. 7 With the aid of a small prytool, separate the boot from the torsion bar



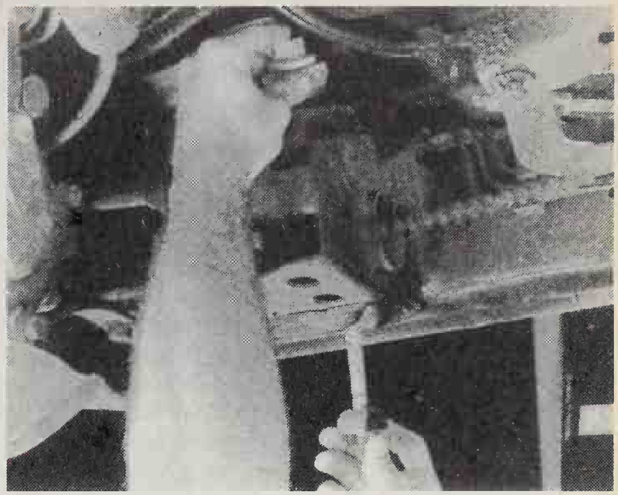
86828p11

Fig. 8 Use paint to matchmark the front also



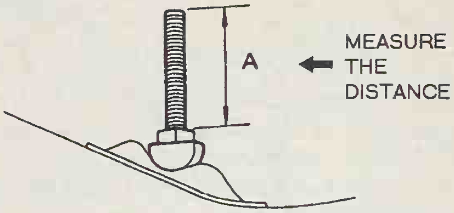
86828p12

Fig. 9 Loosen the long bolt that passes through the arm



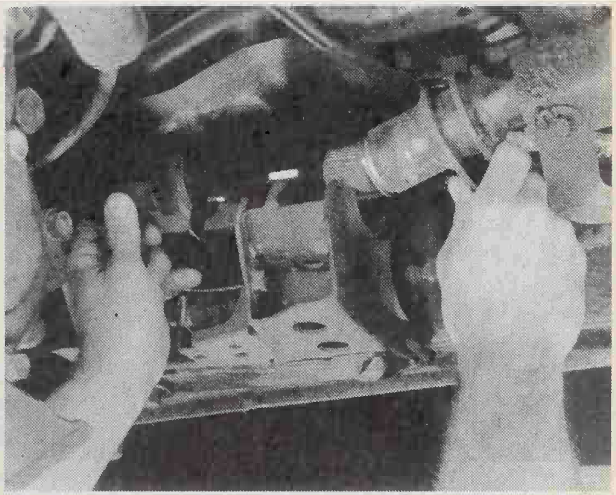
86828p13

Fig. 10 Slide the bolt out of the arm



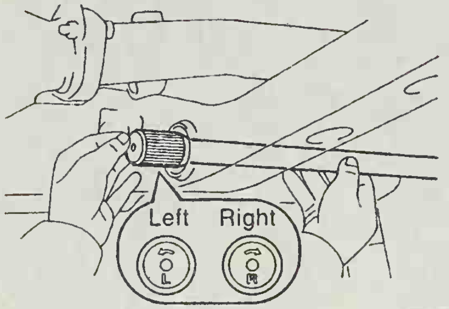
86828g04

Fig. 11 Measure the distance between the shoulder and the tip of the bolt



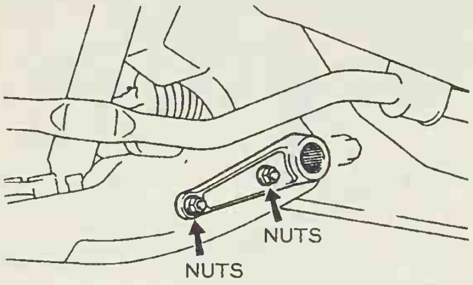
86828p14

Fig. 12 The bar should slide from the housing



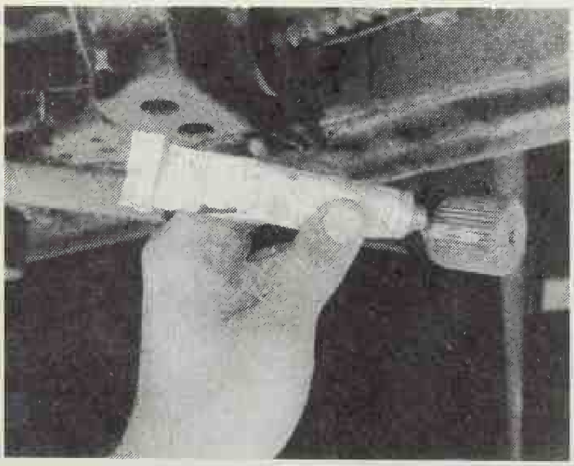
86828g06

Fig. 13 When you remove the torsion bar, note that some models have markings for the left and right



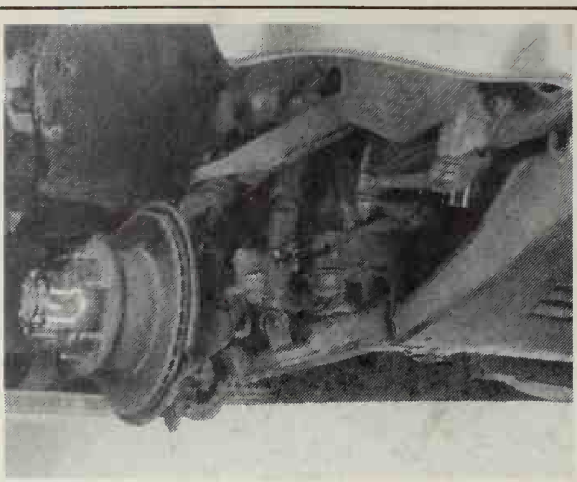
86828g07

Fig. 14 Loosen these two nuts to remove the anchor arm



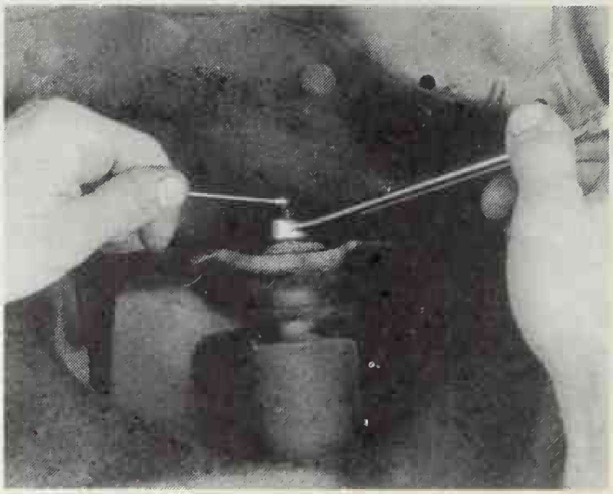
86828p15

Fig. 15 Coat the splined ends of the torsion bar with multi-purpose grease



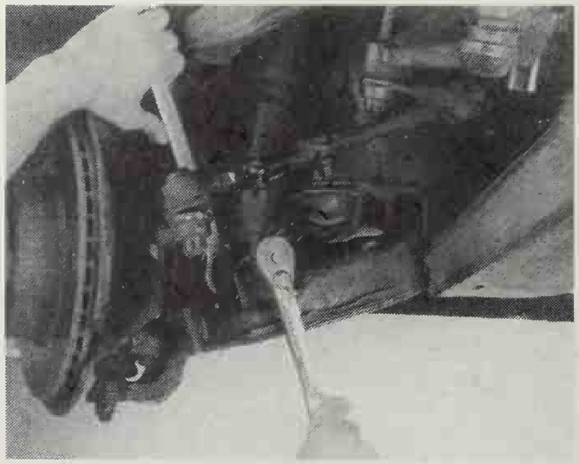
86828p16

Fig. 16 When the wheel is off and the truck raised, you have better access to the suspension



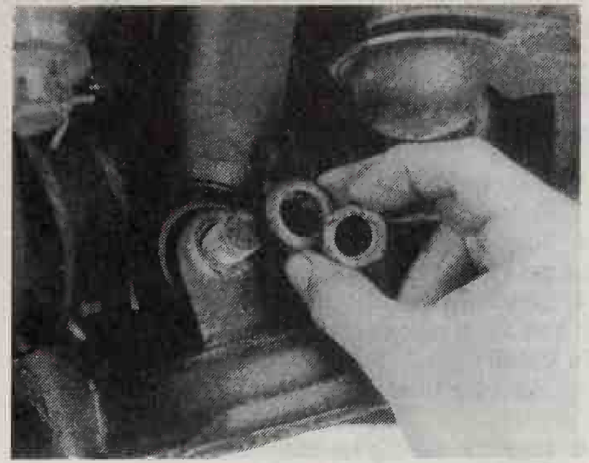
86828p17

Fig. 17 Remove the upper mounting nut for the shock



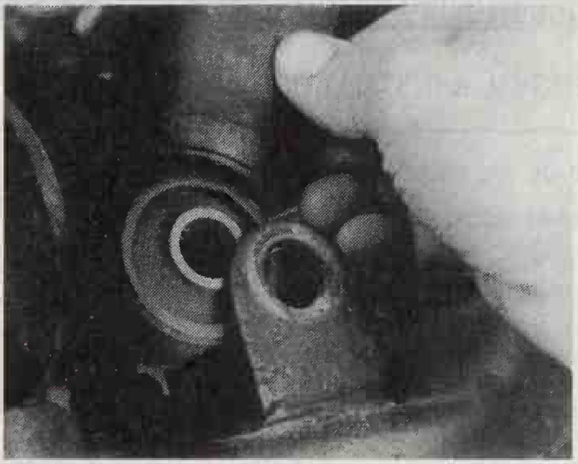
86828p18

Fig. 18 With two tools and a good grip, loosen the mounting bolt and nut



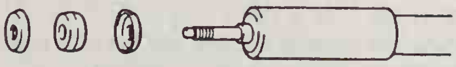
86828p19

Fig. 19 A nut and washer are on the one side when the bolt is removed



86828p20

Fig. 20 Pull the shock out of the mounting bracket, then slide the unit down and out



86828g11

Fig. 21 Place the retainer, cushion and other retainer on the shock in the correct order and position

dampers, the up and down motion of the vehicle would multiply until the vehicle was alternately trying to leap off the ground and to pound itself into the pavement.

Contrary to popular rumor, the shocks do not affect the ride height of the vehicle, nor do they affect the ride quality except for limiting the pitch or bounce. These factors are controlled by other suspension components such as springs and tires. Worn shock absorbers can affect handling; if the front of the vehicle is rising or falling excessively, the "footprint" of the tires changes on the pavement and steering response is affected. The simplest test of the shock absorbers is simply to push down on one corner of the unladen vehicle and release it.

Observe the motion of the body as it is released. In most cases, it will come up beyond its original rest position, dip back below it and settle quickly to rest. This shows that the damper is slowing and controlling the spring action. Any tendency to excessive pitch (up-and-down) motion or failure to return to rest within 2-3 cycles is a sign of poor function within the shock absorber.

While each shock absorber can be replaced individually, it is recommended that they be changed as a pair (both front or both rear) to maintain equal response on both sides of the vehicle. Chances are quite good that if one has failed, its mate is weak also.

INSPECTION

Once removed, the shock should be carefully inspected for any signs of leakage. Oil-filled shocks may have a light film of oil around the seal, resulting from normal breathing and air exchange. This should NOT be taken as a sign of failure, but any sign of thick or running oil definitely indicates failure. Gas filled shocks may also show some film at the shaft; if the gas has leaked out, the shock will have almost no resistance to motion.

Hold the shock firmly in each hand and compress it; compression should be reasonably even and smooth. Release the piston end; it should return smoothly and at an even pace. Stretch the shock, checking again for smooth motion and any abnormal resistance.

DISPOSAL OF GAS-FILLED SHOCK ABSORBERS

The factory installed gas shocks found on some vehicles contain nitrogen. The gas is under pressure, even with the shock removed from the vehicle. To eliminate the possibility of explosion after disposal, the shock case must be drilled to release the gas.

Drill a 0.079-0.118 in. (2-3mm) hole at a point 1.18 in. (30mm) above the base of the shock case. Drill a second hole 1.97 in. (50mm) below the edge of the piston cover (with the shock compressed).

✳✳CAUTION

Although nitrogen is non-toxic and non-flammable, the escaping gas may carry metal chips from the drill; always wear eye or full-face protection when drilling.

Once the gas is released, the shock absorber may be safely discarded.

Lower Ball Joint

INSPECTION

To check the lower ball joint for wear, jack up the front of the vehicle and support it with stands. Remove excess play from the other suspension parts (wheel bearings, tie rods, etc.). Have an assistant press the brake pedal; Move the lower suspension arm up and down, checking that the lower ball joint has minimal play, if any. The maximum allowable vertical play is 0.079 in. (2.3mm). If the play is greater, replace the ball joint. The upper ball joint is subject to the same limit on trucks; the 4Runner upper ball joint must have no play at all. The upper ball joint is tested by moving the wheel and tire up and down.

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Raise the vehicle and support it with jackstands.
2. Remove the front wheel.
3. Support the lower control arm with a floor jack and remove the steering knuckle.
4. Loosen the mounting bolts and remove the lower ball joint from the lower control arm.

To install:

5. Attach the lower ball joint and tighten the nut to 94 ft. lbs. (127 Nm).
6. Install the steering knuckle. Install the wheels and lower the truck.
7. Have the alignment checked at a reputable repair facility.

Tacoma and 1996 4Runner

1. Remove the front wheel.
2. Support he lower control arm with a suitable jack.
3. On the lower ball joint, separate the tie rod end from the steering knuckle. Throw out the old cotter pin.
4. Remove the cotter pin and nut from the lower ball joint. Discard the cotter pin.
5. With a ball joint remover, separate the ball joint from the lower control arm.

To install:

6. Install the ball joint with the mounting nut and bolts.
7. Tighten the nut to 80 ft. lbs. (108 Nm) on the Tacoma, 105 ft. lbs. (142 Nm) 4Runner. Install a new cotter pin in the hole.
8. Attach the tie rod end tightening the nut to 66 ft. lbs. (90 Nm) on 4Runner and 53 ft. lbs. (72 Nm) Tacoma.
9. Install a new cotter pin.
10. Tighten the lower ball joint set bolts, 59 ft. lbs. (80 Nm) on 4Runner and 116 ft. lbs. (160 Nm) on Tacoma.
11. Remove the jack slowly, making sure everything is secure and in place.
12. Install the wheel, lower the vehicle and tighten the lug nuts.
13. Check the ABS speed sensor signal and front wheel alignment.

T100

1. Raise the vehicle and support it with jackstands.
2. Remove the front wheel.
3. Support the lower control arm with a floor jack and remove the steering knuckle.
4. Loosen the mounting bolts and remove the lower ball joint from the lower control arm.

To install:

5. Attach the lower ball joint and tighten the nut to 55 ft. lbs. (75 Nm).
6. Install the steering knuckle.
7. Install the wheels and lower the truck.
8. Check the ABS speed sensor signal and front wheel alignment.

Upper Ball Joint

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Raise the vehicle and support it with jackstands.
2. Remove the front wheel.
3. Support the lower control arm with a floor jack and remove the cotter pin and castellated nut from the knuckle.
4. Unbolt the upper ball joint from the upper control arm and remove the ball joint from the vehicle.

To install:

5. Install the upper ball joint and tighten the bolts to 23 ft. lbs. (31 Nm) for the Pick-Up, or 25 ft. lbs. (33 Nm) for the 4Runner.
6. Attach the lower ball joint and tighten the nut to 94 ft. lbs. (127 Nm).
7. Install the steering knuckle. Install the wheels and lower the truck.
8. Have the alignment checked at a reputable repair facility.

Tacoma

➧ See Figure 22

1. Remove the front wheel.
2. Remove the steering knuckle with the axle hub.
3. Separate the upper ball joint as follows:
   a. Remove the wire and boot.
   b. Using a snapring expander, remove the snapring.
   c. With a ball joint remover and a deep socket, remove the upper ball joint.

To install:

4. With the aid of the ball joint installer and a socket wrench, install the ball joint.
5. Using a snapring expander, install a new snapring.
6. Apply multi-purpose grease, then install a new boot. Fix it with a new wire.
7. Install the steering knuckle with the axle hub.

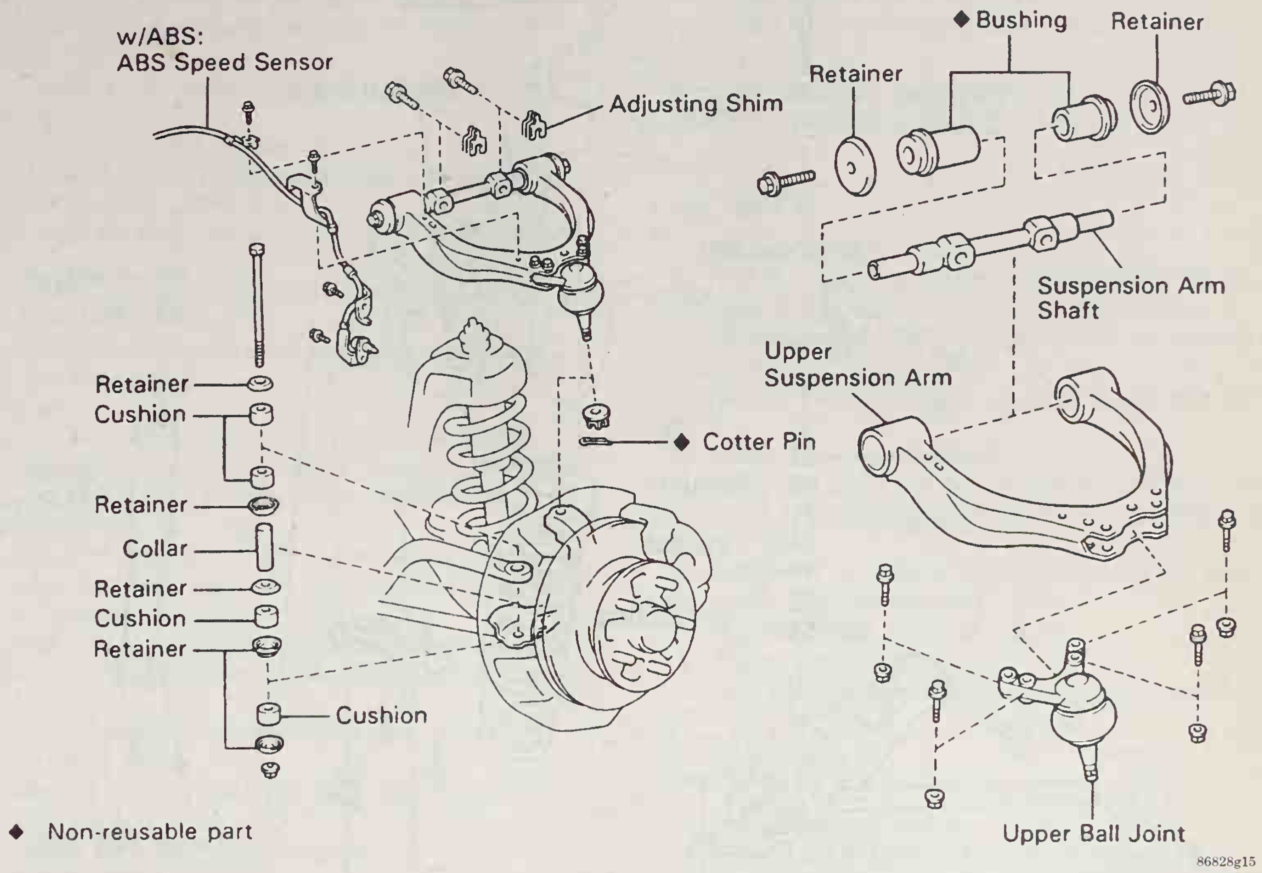

w/ABS:
ABS Speed Sensor
Adjusting Shim
◆ Bushing
Retainer
Retainer
Suspension Arm Shaft
Upper Suspension Arm
Cotter Pin
Retainer
Cushion
Retainer
Collar
Retainer
Cushion
Retainer
Cushion
◆ Non-reusable part
Upper Ball Joint
86828g15

Fig. 22 Exploded view of the upper ball joint and associated components — Tacoma shown

8. Install the front wheel, lower the vehicle and tighten the lug nuts.
9. Have the alignment checked at a reputable repair facility.

Strut Bar

REMOVAL & INSTALLATION

Pick-Up and T100

1. Remove the wheels, raise the truck and support it on safety stands.
2. On some models it will be necessary to remove the engine under cover.
3. Paint matchmarks on the strut bar and retaining nut.
4. Remove the retaining nut from the front of the bar.
5. Remove the nuts holding the bar to the lower control arm and lift out the strut bar.

To install:

6. Position the bar and install the front nut so that the matchmarks line up.
7. Slide the washer and bushing onto the bar and install it to the bracket at the rear.
8. Install the collar, bushing and washer to the other side and then connect the rear of the bar to the control arm. Tighten the mounting nut to 70 ft. lbs. (95 Nm) for the Pick-Up, or 55 ft. lbs. (75 Nm) for the T100.
9. Lower the truck and bounce it several times to set the suspension.
10. Tighten the front nut to 90 ft. lbs. (123 Nm) and check the alignment.

Tacoma

➧ See Figure 23

1. Remove the front wheel.
2. Remove the shock absorber.
3. Compress the spring using a spring compressor, according to the tool manufacturer's instructions.

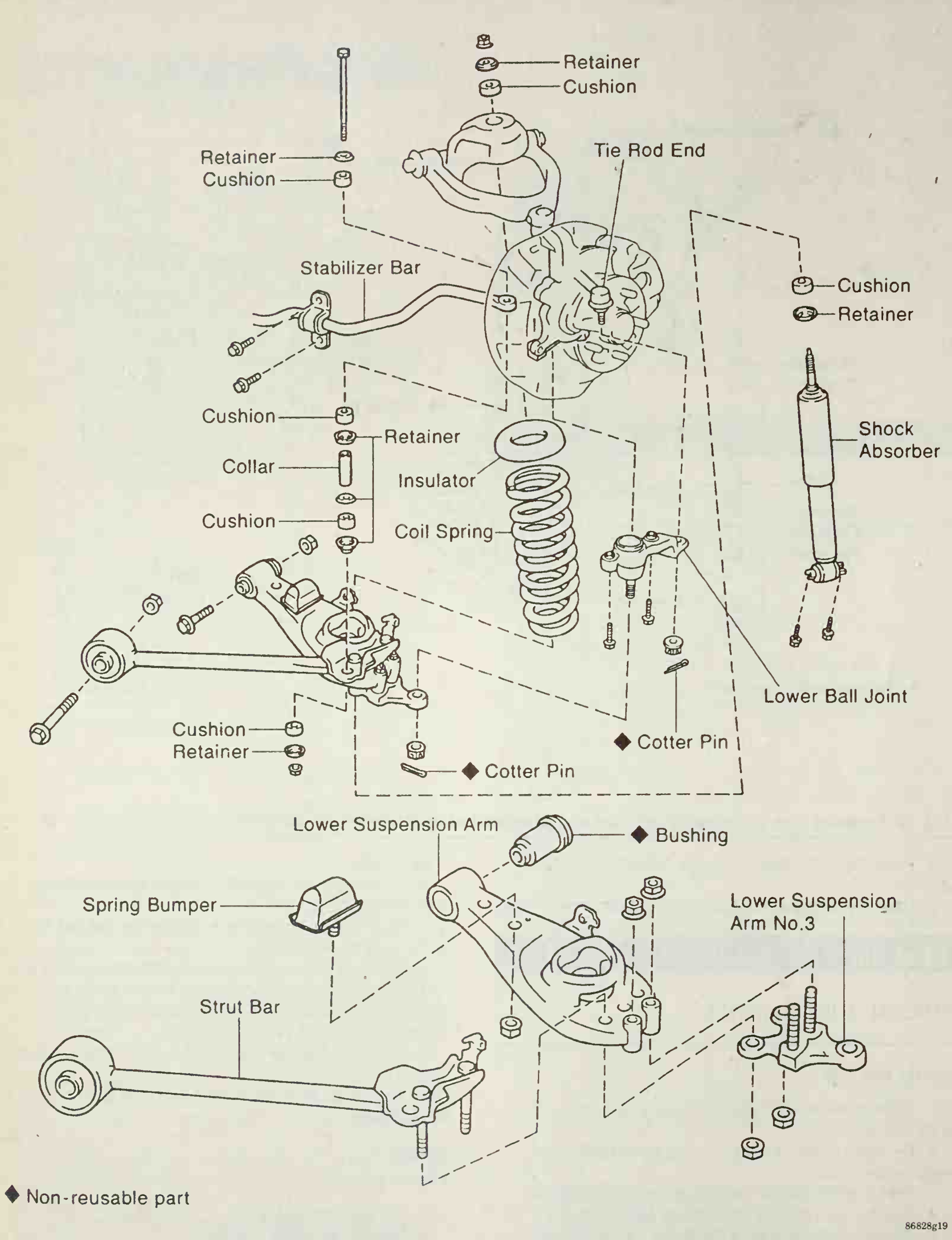

Retainer
Cushion
Retainer
Cushion
Tie Rod End
Stabilizer Bar
Cushion
Retainer
Cushion
Retainer
Collar
Cushion
Insulator
Coil Spring
Shock Absorber
Lower Ball Joint
◆ Cotter Pin
Cushion
Retainer
◆ Cotter Pin
Lower Suspension Arm
◆ Bushing
Spring Bumper
Lower Suspension Arm No.3
Strut Bar
◆ Non-reusable part
86828g19

Fig. 23 Exploded view of the strut bar and associated components — Tacoma

4. Disconnect the stabilizer bar as follows:
   a. Remove the nut and stabilizer bar link from the lower control arm.
   b. Remove the 2 stabilizer bar bracket set bolts.
5. Remove the lower control arm and strut bar as follows:
   a. Support the upper control arm and steering knuckle securely.
   b. Support the upper control arm and steering knuckle assembly.
   c. Remove the cotter pin and nut.
   d. Using a ball joint extractor, disconnect the lower ball joint from the lower control arm.
   e. Loosen the lower control arm set bolt and remove the nut.
   f. Loosen the strut bar front set bolt, then remove the nut.
   g. Pull out the bolts and remove the lower control arm along with the strut bar.

To install:

6. Install the lower control arm and strut bar as follows:
   a. Attach the strut bar front set bolt, tighten to 221 ft. lbs. (300 Nm) make sure the suspension is stabilized prior to tightening the bolt.
   b. Install the lower control arm set bolt and nut, tighten to 148 ft. lbs. (200 Nm). Make sure the suspension is stabilized prior to tightening the bolt.
   c. Install the lower ball joint with a ball joint installer tool. Install the nut and cotter pin. Tighten the nut to 80 ft. lbs. (110 Nm).
7. Attach the stabilizer bar bracket set bolts, tighten to 22 ft. lbs. (29 Nm).
8. Install the stabilizer link to the lower control arm, tighten to 29 ft. lbs. (39 Nm).
9. Remove the spring compressing tool.
10. Install the shock absorber.
11. Install the wheel, lower the truck and tighten the lug nuts.
12. Have the alignment checked at a reputable repair facility.

Stabilizer Bar (Sway Bar)

REMOVAL & INSTALLATION

Pick-Up

1. Raise the truck and support it on safety stands. Remove the wheels.
2. Remove one torsion bar spring.
3. Remove the nuts and cushions at both sides of the stabilizer bar where it attaches to the control arms.
4. Remove the 2 bushings and brackets at the frame member. Remove the stabilizer bar.

➡Examine the rubber bushings very carefully for any splits or deformation. Clean the inner and outer surfaces of the bushings before reinstallation. Failed or dirty bushings can create a chorus of odd noises under the vehicle, particularly during cornering.

To install:

5. Position the stabilizer bar and install the 2 center bushings and brackets to the frame. Finger-tighten the bolts.
6. Connect the bar to the control arms on each side. Use new nuts and tighten to 9 ft. lbs. (13 Nm).
7. Tighten the center bracket bolts to 9 ft. lbs. (13 Nm) and install the torsion bar.
8. Install the wheels and lower the truck.
9. Have the alignment checked at a reputable repair facility.

Tacoma

➧ See Figure 24

1. Remove the front wheels.
2. Hold the bolt with a wrench, then remove the nut, retainer, collar and cushion from the lower control arm.
3. Remove the bolts and stabilizer bar with the cushions and brackets.
4. Remove the brackets and cushions from the stabilizer bar.

To install:

5. Install the cushions to the inside of the paint mark. Attach the bar with the brackets, tighten the bracket bolts to 22 ft. lbs. (29 Nm).
6. Tighten the nut holding the lower control arm components to 29 ft. lbs. (39 Nm).
7. Install the wheel, lower the vehicle.
8. Tighten the lug nuts.
9. Have the alignment checked at a reputable repair facility.

4Runner

➧ See Figure 25

1. Remove the front wheels.
2. Disconnect the stabilizer bar links as follows:
   a. Remove the nuts and disconnect the stabilizer bar links from the lower control arm.
   b. Hold the link with a wrench, then remove the nut, retainers, cushions and link.
3. Remove the bolts and stabilizer bar with cushions and brackets.

To install:

4. Place the stabilizer bar into position, then install the both bar cushions and brackets to the frame. Temporarily install the bolts. Tighten to 19-22 ft. lbs. (25-29 Nm).
5. Hold the stabilizer bar link with a wrench, then install the link onto the lower control arm with a new nut. Tighten the nut to 14-19 ft. lbs. (19-25 Nm).
6. Using a hexagon wrench, connect the stabilizer bar on both sides to the links with new nuts, tighten to 55-70 ft. lbs. (69-95 Nm).
7. Install the front wheels.
8. Have the alignment checked at a reputable repair facility.

Upper Control Arm

REMOVAL & INSTALLATION

Pick-Up

1. Raise and support the truck under the frame.

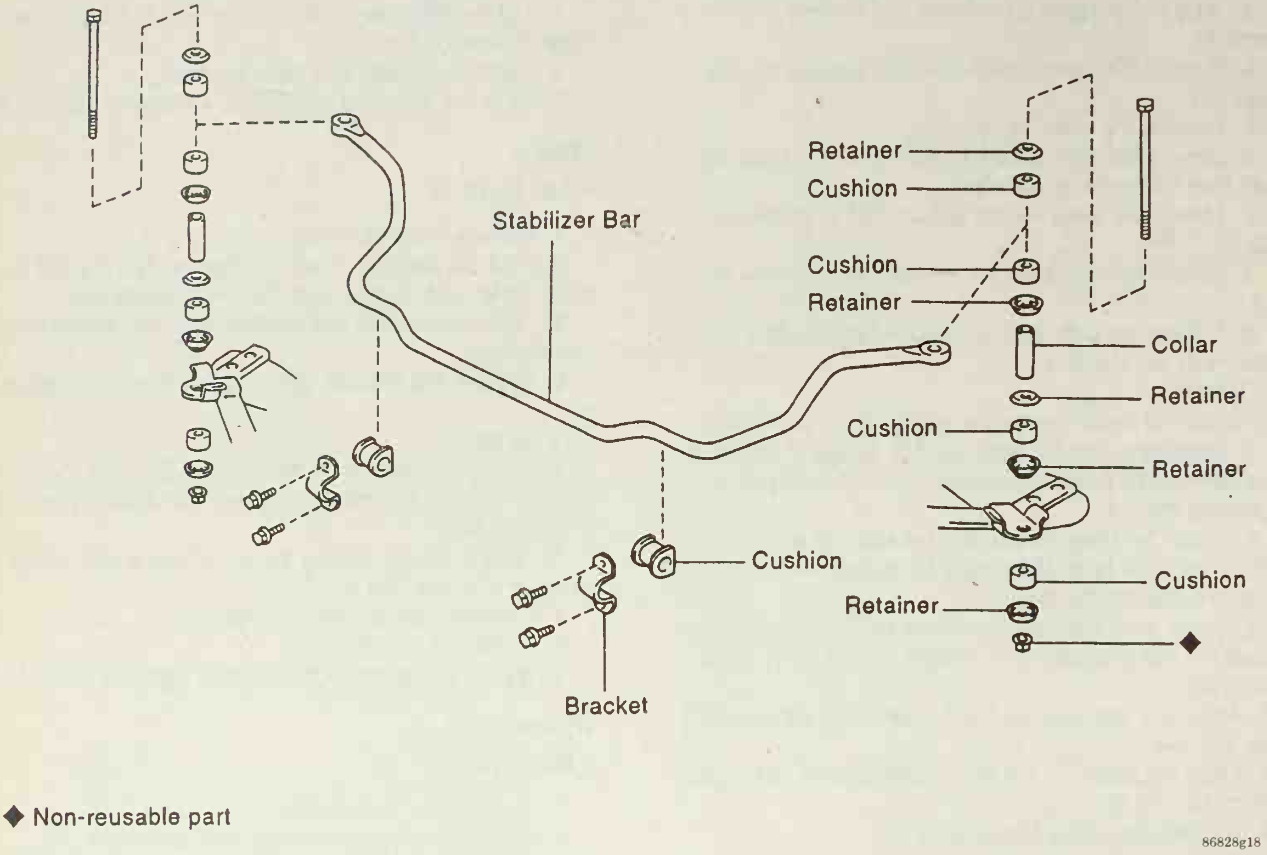


Fig. 24 Exploded view of the stabilizer bar and associated components — Tacoma shown

2. Remove the wheel.
3. Raise the lower control arm with a floor jack.
4. Remove the 4 nuts from the upper ball joint and disconnect the joint from the upper arm.
5. Unbolt and remove the upper arm at the 2 bolts holding the inner shaft to the frame, taking note of the number, size and position of the aligning shim.

To install:

6. Install the upper arm with the adjusting shims in the same position and the same number as they were before removal. Tighten the bolts to 71 ft. lbs. (96 Nm).
7. Install the upper ball joint to the arm and tighten the bolts to 23 ft. lbs. (31 Nm).
8. Install the wheel.
9. Lower the truck and bounce it several times to set the suspension. Tighten the upper control arm shaft bolts to 93 ft. lbs. (126 Nm).
10. Have the alignment checked at a reputable repair facility.

Tacoma

1. Raise and support the vehicle.
2. Remove the front wheel.
3. Removed the ABS sped sensor and wire harness.
4. Remove the stabilizer bar link.
5. Disconnect the steering knuckle from the upper bar joint.
6. Loosen the 2 bolts,m then remove the front and rear alignment adjusting shims.
7. Make not of the number and thickness of the front and rear shims.
8. Unbolt the upper control arm.
9. Remove the bolts, nuts and upper ball joint from the arm.

To install:

10. Attach the ball joint to the arm, tighten to 29 ft. lbs. (39 Nm).

➡Do not lose the camber adjusting shims. Record the position and thickness of the camber shims so that these can be reinstalled to there original locations. Install the equal number and thickness of shims into there locations.

11. Install the arm to the vehicle, with the shims, then tighten the mounting bolts to 94 ft. lbs. (130 Nm).

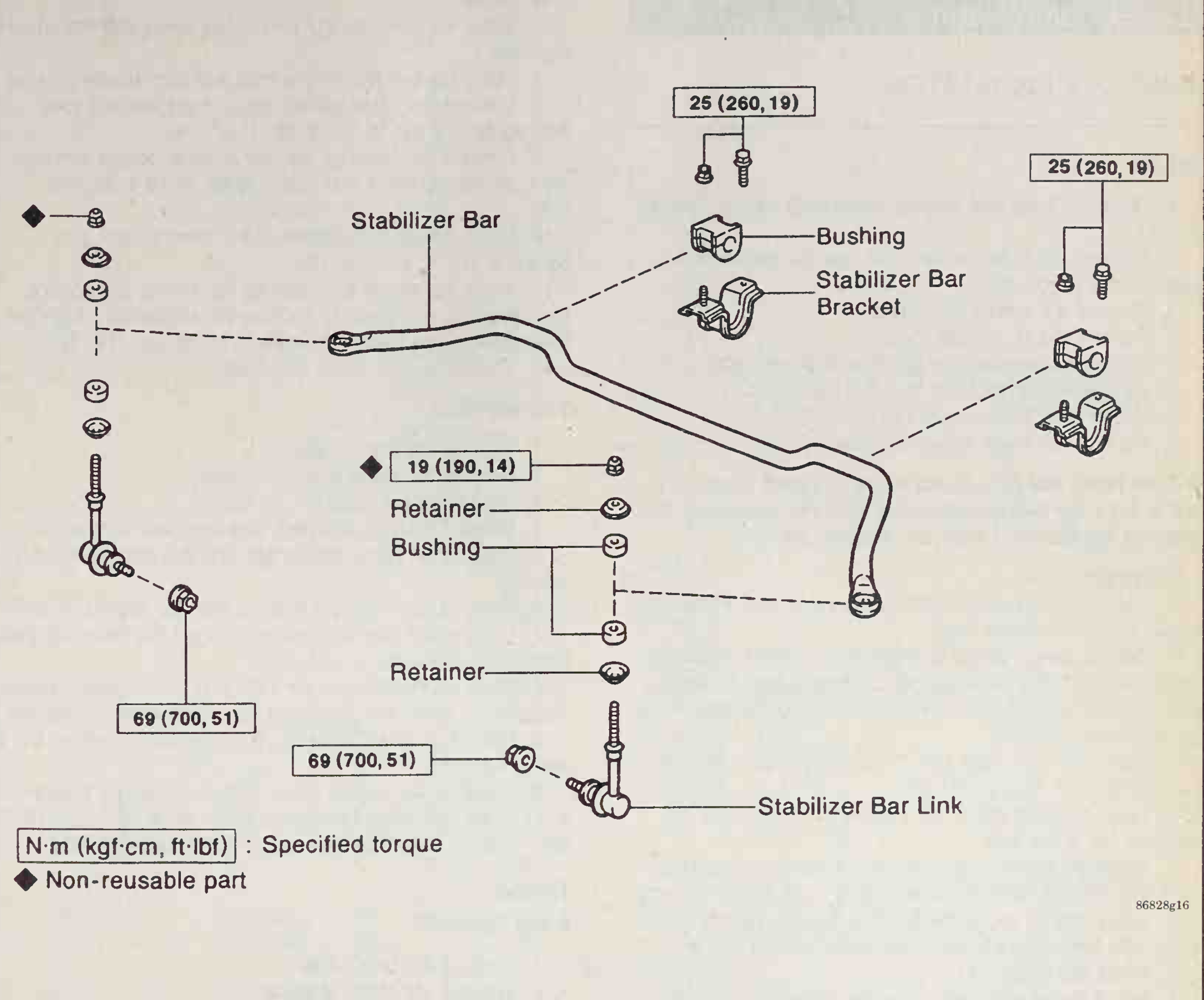

25 (260, 19)
25 (260, 19)
Stabilizer Bar
Bushing
Stabilizer Bar Bracket
◆ 19 (190, 14)
Retainer
Bushing
Retainer
69 (700, 51)
69 (700, 51)
Stabilizer Bar Link
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g16

Fig. 25 Exploded view of the front stabilizer bar components — 1996 4Runner shown

12. Attach the steering knuckle to the upper ball joint.
13. Install the stabilizer bar link.
14. Install the ABS speed sensor and wire harness.
15. Place the wheel into position, hand tighten the lug nuts.
16. Lower the vehicle, tighten the lug nuts to 83 ft. lbs. (110 Nm).
17. Have the alignment checked at a reputable repair facility.

T100

1. Raise and support the vehicle.
2. Remove the front brake caliper.
3. On models with ABS, disconnect the ABS speed sensor wire from the upper control arm.
4. Support the lower control arm with a jack. Remove the nuts and disconnect ball joint from the upper control arm.
5. Remove the bolts and camber adjusting shims.
6. Remove the upper control arm.

➡Do not lose the camber adjusting shims. Record the position and thickness of the camber shims so that these can be reinstalled to there original locations. Install the equal number and thickness of shims into there locations.

To install:

7. Attach the upper control arm with the shims in there correct positions.
8. Tighten the bolts to 71 ft. lbs. (96 Nm).
9. Install the nuts to the upper control arm, tighten to 23 ft. lbs. (31 Nm).
10. Attach the ABS speed sensor and harness to the upper control arm.
11. Install the brake caliper.
12. Install the wheel, lower the vehicle.
13. Tighten the lug nuts.
14. Bleed the brake system.
15. Have the alignment checked at a reputable repair facility.

Lower Control Arm

REMOVAL & INSTALLATION

Pick-Up

1. Raise the truck and support it on safety stands. Remove the wheels.
2. Remove the cotter pin and nut; use the correct tool to separate the tie rod end.
3. Remove the torsion bar spring.
4. Remove the shock absorber.
5. Disconnect the stabilizer bar from the lower arm.
6. Disconnect the strut bar from the lower arm.
7. Unbolt and remove lower ball joint.
8. Remove the lower suspension arm.

➡If the lower ball joint is not to be replaced, simply unbolt it from the lower control arm. It is not necessary to separate the ball joint from the steering knuckle.

To install:

9. Install the torque arm bolts to the lower arm. Place the torque arm on the lower shaft.
10. Set the torque arm in its installation position, install the lower arm shaft and the torque arm. Finger-tighten the lower arm bolts and then remove the torque arm. Do not tighten the nut much beyond snug.
11. Attach the lower ball joint to the suspension arm. Tighten the 3 bolts to 94 ft. lbs. (127 Nm).
12. Install the strut bar to the lower arm and connect the stabilizer bar to the arm.
13. Install the shock absorber. Tighten the lower mount to 13 ft. lbs. (18 Nm) and the upper mount to 18 ft. lbs. (25 Nm).
14. Attach the tie rod to the knuckle. Tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin to secure the nut.
15. Install the torsion bar.
16. Install the wheel(s) and lower the vehicle. Bounce the front end several times to stabilize the suspension.
17. Tighten the lower suspension nut to 166 ft. lbs. (226 Nm.)

⁂WARNING

Do not tighten the control arm bolt fully until the vehicle is lowered. If the bolts are tightened with the control arm(s) hanging, excessive bushing wear will result.

18. Have the alignment checked at a reputable repair facility.

4Runner

1989-95 MODELS

1. Remove the shock absorber.
2. Disconnect the stabilizer bar from the lower control arm.
3. Disconnect the lower control arm from the lower ball joint. Discard the old cotter pin. A ball joint separator will be needed.
4. Place matchmarks on the front and rear adjusting cams.
5. Remove the nuts and adjusting cams, then remove the lower control arm.

To install:

6. Install the lower control arm to the frame with the adjusting cams.
7. Install the two nuts to the front and rear adjusting cams.
8. Connect the lower control arm to the lower ball joint, then tighten the nut to 105 ft. lbs. (142 Nm).
9. Connect the stabilizer bar link to lower control arm with the cushions, retainers and nuts. Tighten to 19 ft. lbs. (25 Nm).
10. Install the shock absorber to the lower control arm, tighten to 101 ft. lbs. (137 Nm).
11. Install the wheel, then remove the stands and bounce the vehicle up and down to stabilize the suspension. Align the matchmarks, then tighten the nuts to 145 ft. lbs. (196 Nm).
12. Check the front wheel alignment.

1996 MODELS

1. Remove the front wheel.
2. Remove the steering gear assembly.
3. Disconnect the stabilizer bar link.
4. Unbolt the shock absorber from the lower control arm.
5. Support the upper control arm and the steering knuckle securely.
6. Remove the cotter pin and nut from the lower ball joint.
7. Using a ball joint remover, disconnect the lower ball joint from the control arm.
8. Place matchmarks on the front and rear adjusting cams. Remove the bolts, nuts, adjusting cams and lower control arm.
9. Using tool SST 09922-10010 or equivalent, remove the 2 spring bumpers.
10. Install in the reverse order. Tighten the spring bumpers to 17 ft. lbs. (23 Nm), the lower control arm to 96 ft. lbs. (130 Nm), and the lower ball joint nut to 105 ft. lbs. (142 Nm).

Tacoma

➧ See Figure 26

1. Remove the front wheel.
2. Remove the shock absorber.
3. Compress the spring using a spring compressor, following the manufacturer's instructions.
4. Disconnect the stabilizer bar as follows:
   a. Remove the nut and stabilizer bar link from the lower control arm.
   b. Remove the 2 stabilizer bar bracket set bolts.
5. Remove the lower control arm and strut bar as follows:
   a. Support the upper control arm and steering knuckle securely.
   b. Support the upper control arm and steering knuckle assembly.
   c. Remove the cotter pin and nut.
   d. Using a ball joint extractor, disconnect the lower ball joint from the lower control arm.
   e. Loosen the lower control arm set bolt and remove the nut.
   f. Loosen the strut bar front set bolt, then remove the nut.
   g. Pull out the bolts and remove the lower control arm along with the strut bar.
6. Remove the coil spring compressor tool and coil.
7. Remove the nuts and strut bar from the lower control arm. Separate the nut and spring bumper.

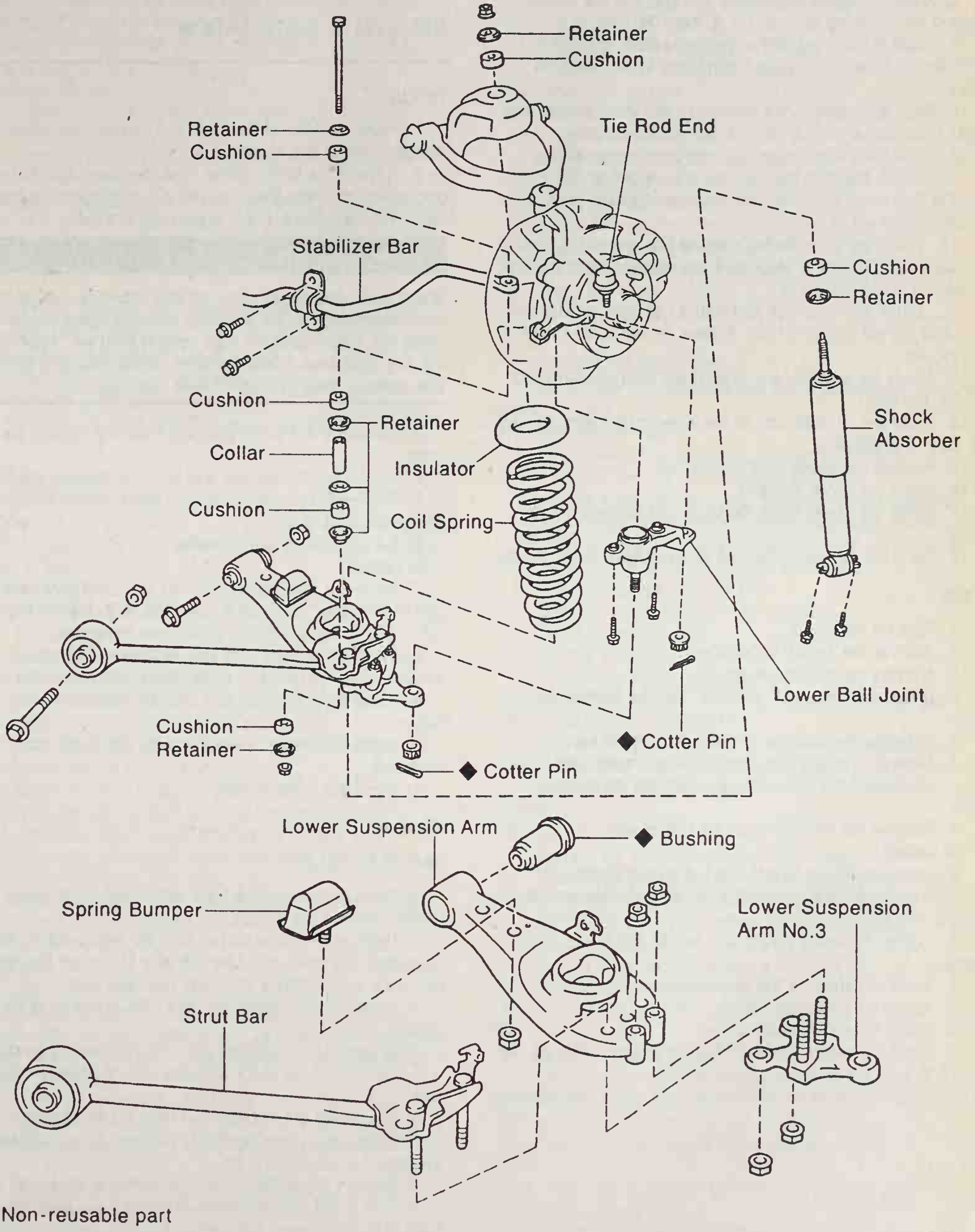

Retainer
Cushion
Retainer
Cushion
Tie Rod End
Stabilizer Bar
Cushion
Retainer
Cushion
Retainer
Collar
Insulator
Shock Absorber
Cushion
Coil Spring
Lower Ball Joint
◆ Cotter Pin
Cushion
Retainer
◆ Cotter Pin
Lower Suspension Arm
◆ Bushing
Spring Bumper
Lower Suspension Arm No.3
Strut Bar
◆ Non-reusable part
86828g01

Fig. 26 Exploded view of the lower control arm and related front suspension components — Tacoma

8. Remove the lower suspension arm No. 3.

To install:

9. Attach the lower suspension arm No. 3 to the vehicle, tighten the mounting bolts to 111 ft. lbs. (150 Nm).

10. Install the spring bumper, tighten to 32 ft. lbs. (43 Nm) and the strut bar to the lower control arm 111 ft. lbs. (150 Nm).

11. Place each end of the coil spring and lower control arm seat in contact when applying the coil spring expander.

12. Install the lower control arm and strut bar as follows:

a. Attach the strut bar front set bolt, tighten to 221 ft. lbs. (300 Nm) make sure the suspension is stabilized prior to tightening the bolt.

b. Install the lower control arm set bolt and nut, tighten to 148 ft. lbs. (200 Nm). Make sure the suspension is stabilized prior to tightening the bolt.

c. Install the lower ball joint with a ball joint installer tool. Install the nut and cotter pin. Tighten the nut to 80 ft. lbs. (110 Nm).

13. Attach the stabilizer bar bracket set bolts, tighten to 22 ft. lbs. (29 Nm).

14. Install the stabilizer link to the lower control arm, tighten to 29 ft. lbs. (39 Nm).

15. Remove the spring compressing tool.

16. Install the shock absorber.

17. Install the wheel, lower the truck and tighten the lug nuts.

18. Have the alignment checked at a reputable repair facility.

T100

1. Remove the wheel.
2. Remove the engine under cover.
3. Remove the torsion bar spring.
4. Disconnect the shock absorber from the lower control arm.
5. Separate the stabilizer bar from the control arm.
6. Separate the strut bar from the lower control arm.
7. Disconnect the lower ball joint from the lower control arm.
8. Remove the nut and lower the control arm.

To install:

9. Attach the lower control arm but do not tighten yet.
10. Attach the lower ball joint, strut bar and stabilizer bar to the control arm.
11. Tighten the lower control arm bolt to 152 ft. lbs. (206 Nm).
12. Install the shock to the control arm.
13. Attach the torsion spring bar.
14. Install the engine under cover.
15. Install the wheel, lower the truck and tighten the lug nuts to 76 ft. lbs. (103 Nm).
16. Have the alignment checked at a reputable repair facility.

Knuckle and Spindle

REMOVAL & INSTALLATION

Pick-Up

1. Raise the front of the truck and support with safety stands. Remove the wheels.
2. Remove the brake caliper from the mount but do not disconnect the brake line. Use stiff wire to support the caliper out of the way. Remove the brake rotor and hub.

✻✻CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

3. Remove the 2 cotter pins and bolts and remove the dust cover.
4. Disconnect the knuckle arm from the steering knuckle.
5. Position a floor jack under the lower control arm and disconnect the ball joints.
6. Remove the steering knuckle.

To install:

7. Install the steering knuckle into the 2 ball joints and tighten the upper nut to 80 ft. lbs. (108 Nm). Tighten the lower nut to 105 ft. lbs. (142 Nm). Install new cotter pins.
8. Install the knuckle arm and dust cover. Tighten the bolts to 80 ft. lbs. (108 Nm) and secure them with new cotter pins.
9. Install the brake disc and hub and install the brake caliper.
10. Install the wheels, lower the truck and check the alignment.
11. Bleed the brake system.

4Runner

1989-95 MODELS

1. Raise the front of the truck and support with safety stands. Remove the wheels.
2. Remove the brake caliper from the mount but do not disconnect the brake line. Use stiff wire to support the caliper out of the way. Remove the brake rotor and hub.
3. Remove the 2 cotter pins and bolts and remove the dust cover.
4. Disconnect the knuckle arm from the steering knuckle.
5. Disconnect the shock absorber from the lower control arm.
6. Disconnect the stabilizer bar from the lower control arm by removing the nut and cushion. Disconnect the stabilizer bar link from the suspension arm.
7. Remove the cotter pin and nut from the upper ball joint.
8. With a ball joint separator, disconnect the steering knuckle from the upper ball joint.
9. Remove the bolts from the lower ball joint. Disconnect the steering knuckle from the joint. Push the lower control arm down and remove the knuckle.

To install:

10. Push the lower control arm down and install the steering knuckle. Connect the lower ball joint to the steering knuckle, then tighten the bolts to 43 ft. lbs. (58 Nm).
11. Attach the upper ball joint to the knuckle, then tighten the nut to 105 ft. lbs. (142 Nm).
12. Install all new cotter pins.
13. Connect the knuckle arm to the steering knuckle as follows:
    a. Clean the threads of the bolts and steering knuckle with trichloroethylene.
    b. Apply sealant to the bolt threads such as Three Bond 1324 or equivalent. Tighten the bolts to 135 ft. lbs. (183 Nm).
14. Install the dust cover, tighten the bolts to 14 ft. lbs. (19 Nm).
15. Pack the bearings with multi-purpose grease and coat the inside of the hub and cap.
16. Install the inner bearing and oil seal.
17. Install the hub and rotor assembly.
18. Bleed the brake system.
19. Have the alignment checked at a reputable repair facility.

T100

➧ See Figure 27

1. Remove the front wheel.
2. On models with ABS, remove the speed sensor from the steering knuckle.
3. Remove the caliper.
4. Check the axle hub bearing backlash as follows:
    a. Remove the cap, cotter pin and lock cap.
    b. Place a dial indicator near the center of the axle hub and check that the backlash in the bearing shaft direction.
    c. The maximum is 0.0020 in. (0.05mm). If the backlash is not within specifications, replace the bearing.
5. Remove the hub with the rotor.
6. Remove the oil seal and inner bearing.
7. Remove the dust cover.
8. Unbolt the knuckle arm from the steering knuckle.
9. Support the lower control arm with a suitable jack.
10. Remove the upper and lower cotter pins.
11. Remove the upper and lower nuts.
12. With a ball joint remover, separate the steering knuckle from the upper and lower ball joints.
13. Remove the knuckle.

To install:

14. Support thew lower control arm with a jack.
15. Install the steering knuckle to the upper ball joint and nut. Push down the upper control arm and steering knuckle to the lower ball joint and nut. Tighten the upper ball joint nut to 80 ft. lbs. (108 Nm).
16. Tighten the lower ball joint nut to 105 ft. lbs. (142 Nm).
17. Install new cotter pins.
18. Attach the knuckle arm to the steering knuckle as follows:
    a. Clean the threads of the bolts and steering knuckle with trichloroethylene.
    b. Apply sealant to the bolt threads such as Three Bond 1324 or equivalent. Tighten the bolts to 135 ft. lbs. (183 Nm).
19. Install the dust cover, tighten the bolts to 14 ft. lbs. (19 Nm).
20. Pack the bearings with multi-purpose grease and coat the inside of the hub and cap.
21. Install the inner bearing and oil seal.
22. Install the hub and rotor assembly.
23. Adjust the preload.
24. Install the lock cap, cotter pin and grease cap.
25. Attach the brake caliper.
26. On models with ABS, connect the ABS speed sensor to steering knuckle, tighten to 71 inch lbs. (8 Nm).
27. Install the front wheel.
28. Lower the vehicle, tighten the lug nuts.
29. Check the front end alignment.
30. On ABS vehicles, check the ABS speed sensor signal.
31. Bleed the brake system.

Tacoma

1. Remove the front wheel.
2. On models with ABS, remove the speed sensor from the steering knuckle.
3. Remove the caliper.
4. Check the axle hub bearing backlash as follows:
    a. Remove the cap, cotter pin and lock cap.
    b. Place a dial indicator near the center of the axle hub and check that the backlash in the bearing shaft direction.
    c. The maximum is 0.0020 in. (0.05mm). If the backlash is not within specifications, replace the bearing.
5. Remove the hub with the rotor.
6. Remove the oil seal and inner bearing.
7. Remove the dust cover.
8. remove the stabilizer bar link.
9. Support the lower control arm with a jack.
10. Loosen the ball joint set bolts. Remove the cotter pin and discard it, then loosen the nut.
11. With a special tool 09628-62011 or its equivalent, remove the ball joint from the steering knuckle.
12. Remove the ball joint set bolts, then the nut and steering knuckle.

To install:

13. Support the lower control arm with a jack.
14. Install the steering knuckle to the upper ball joint and nut. Push down the upper control arm and steering knuckle to the lower ball joint and nut. Tighten the upper ball joint nut to 80 ft. lbs. (110 Nm).
15. Tighten the lower ball joint nut to 116 ft. lbs. (160 Nm).
16. Install new cotter pins.
17. Install the dust cover, tighten the bolts to 14 ft. lbs. (19 Nm).
18. Install the stabilizer bar link.
19. Pack the bearings with multi-purpose grease and coat the inside of the hub and cap.
20. Install the inner bearing and oil seal.
21. Attach the knuckle arm to the steering knuckle as follows:
    a. Clean the threads of the bolts and steering knuckle with trichloroethylene.
    b. Apply sealant to the bolt threads such as Three Bond 1324 or equivalent. Tighten the bolts to 135 ft. lbs. (183 Nm).
22. Install the hub and rotor assembly.

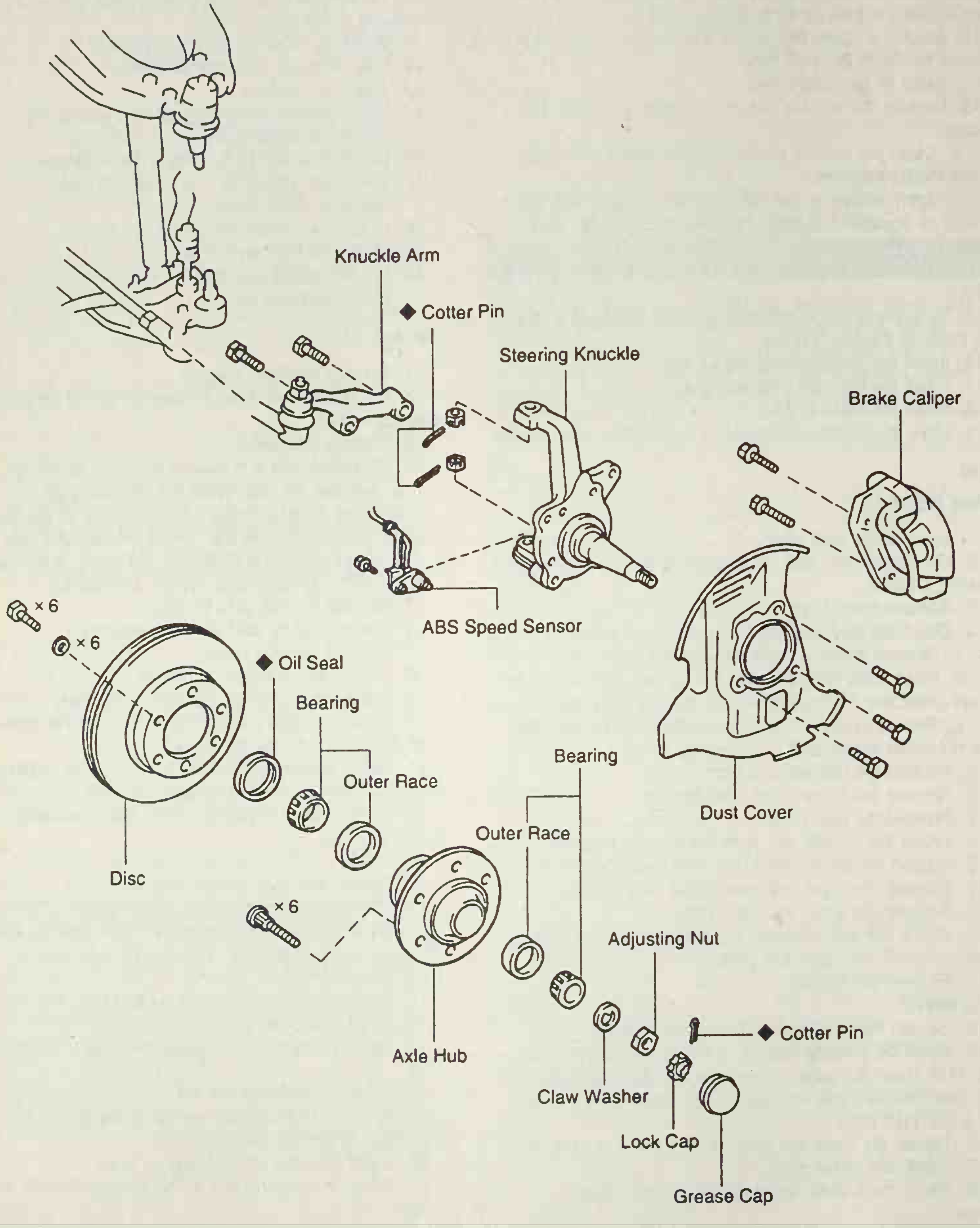

Knuckle Arm
◆ Cotter Pin
Steering Knuckle
Brake Caliper
ABS Speed Sensor
× 6
× 6
◆ Oil Seal
Bearing
Outer Race
Disc
Bearing
Outer Race
Dust Cover
× 6
Axle Hub
Adjusting Nut
◆ Cotter Pin
Claw Washer
Lock Cap
Grease Cap
◆ Non-reusable part
86828g23

Fig. 27 Exploded view of the front hub and steering knuckle and other suspension components — T100

23. Adjust the preload.
24. Install the lock cap, cotter pin and grease cap.
25. Attach the brake caliper.
26. On models with ABS, connect the ABS speed sensor to steering knuckle, tighten to 71 inch lbs. (8 Nm).
27. Install the front wheel.
28. Lower the vehicle, tighten the lug nuts.
29. Check the front end alignment.
30. On ABS vehicles, check the ABS speed sensor signal.
31. Bleed the brake system.

Front Axle Hub and Bearing

REMOVAL & INSTALLATION

1. Raise the front of the truck and support with safety stands. Remove the wheels.
2. Remove the brake caliper and suspend it with wire, out of the way. Remove the caliper mount bracket (torque plate).
3. Remove the axle end cap and then remove the cotter pin, nut lock and nut.
4. Pull the hub/disc assembly off the spindle with the outer bearing. Don't let the bearing fall out.
5. Pry the inner oil seal out and remove the inner bearing from the hub.
6. Clean the bearings and outer races and inspect them for wear or cracks.

To install:

7. Using a brass drift and a hammer, drive out the bearing outer race. Press a new one into position.
8. Pack the bearings with grease until it oozes out the other side. Coat the inside of the hub and cap with grease.
9. Position the inner bearing into the hub, coat the oil seal with grease and press it into the hub.
10. Press the hub assembly onto the spindle and install the outer bearing and thrust washer.
11. Install the hub nut and tighten. Turn the hub a few times to seat the bearings, then loosen the nut until there is no more than 0.02 in. (0.5mm) play. Using a spring tension gauge, check that the preload is 1.3-4.0 lbs.
12. Install the locknut, new cotter pin and hub grease cap.
13. Install the brake torque plate to the knuckle. Install the brake caliper.
14. Bleed the brake system.
15. Install the wheels and lower the vehicle.

Front End Alignment

Alignment of the front wheels is essential if your vehicle is to go, stop and turn as designed. Alignment can be altered by collision, overloading, poor repair or bent components.

If you are diagnosing bizarre handling and/or poor road manners, the first place to look is the tires. Although the tires may wear as a result of an alignment problem, worn or poorly inflated tires can make you chase alignment problems which don't exist.

Once you have eliminated all other causes, unload everything from the trunk except the spare tire, set the tire pressures to the correct level and take the truck to a reputable alignment facility. Since the alignment settings are measured in very small increments, it is almost impossible for the owner/mechanic to accurately determine the settings. The explanations that follow will help you understand the three dimensions of alignment: caster, camber and toe.

CASTER

Caster is the tilting of the steering axis either forward or backward from the vertical, when viewed from the side of the vehicle. A backward tilt is said to be positive and a forward tilt is said to be negative. Changes in caster affect the straight line tendency of the vehicle and the "return to center" of the steering after a turn. If the camber is radically different between the left and right wheels (such as after hitting a major pothole), the truck will exhibit a nasty pull to one side.

Caster is adjustable through the use of shims, which reposition the suspension components in the correct direction.

CAMBER

Camber is the tilting of the wheels from the vertical (leaning in or out) when viewed from the front of the vehicle. When the wheels tilt outward at the top, the camber is said to be positive. When the wheels tilt inward at the top the camber is said to be negative. The amount of tilt is measured in degrees from the vertical. This measurement is called camber angle.

Camber affects the position of the tire on the road surface during vertical suspension movement and cornering. Changes in camber affect the handling and ride qualities of the truck as well as tire wear. Many tire wear patterns indicate camber related problems from misalignment, overloading or poor driving habits.

Camber is adjustable on Pick-Ups and 4Runners through the use of shims; if the measurement is out of specification, the bent or damaged component(s) must be replaced.

TOE-IN

Toe is the turning in or out (parallelism) of the wheels. The actual amount of toe setting is normally only a fraction of an inch. The purpose of toe-in (or out) specification is to insure parallel rolling of the wheels. Toe-in also serves to offset the small deflections of the steering support system which occur when the vehicle is rolling forward or subjected to hard braking.

Changing the toe setting will radically affect the overall "feel" of the steering, as well as the vehicle's braking ability, tire wear and fuel economy. Excessive toe (in or out) causes excessive drag or scrubbing on the tires.

Toe is adjustable on all vehicles covered by this manual, and is generally measured in inches or degrees. It is adjusted by loosening the locknut on each tie rod end and turning the rod until the correct reading is achieved. The left and right rods must remain equal in length during all adjustments.

4WD FRONT SUSPENSION

After you work on the suspension of your truck, it is advisable to have the alignment checked at a reputable repair facility. This will ensure that your front end is in order after repairs.

Coil Springs

REMOVAL & INSTALLATION

Land Cruiser

➧ See Figure 28

1. Elevate and safely support the vehicle. Make certain the jackstands are securely placed under the frame rails.
2. Use a floor jack to slightly jack and support the front axle housing. Hold the piston rod of the shock absorber and remove the upper mounting nut. Hold the shock and remove the lower mounting nut, the cushions and the retainer.
3. Disconnect the stabilizer bar from the axle housing.
4. Lower the jack holding the front axle. Use a spring compressor to compress the spring. Remove the spring, still compressed, from the vehicle. Place the spring, facing away from you, on the work bench and slowly release the tension on the compressor. When the spring is fully extended, remove the tool.
5. Remove the follow spring nuts and spring.

To install:

6. Install the follow spring, tighten the nuts to 82 inch lbs. (9 Nm).
7. Compress the spring and fit it into position in the vehicle. Align the end with the lower spring seat; slowly release the compressor, allowing the spring to expand into place.
8. Install the stabilizer bar.
9. Install the shock absorber. Tighten the lower mounting nut to 51 ft. lbs. (69 Nm) and then the upper mount to the same value.
10. Lower the vehicle to the ground.

4Runner

➧ See Figure 29

1. Remove the front wheel.
2. Disconnect the shock absorber from the the lower control arm. When you lower the arm, remove the bolt and disconnect the shock absorber.
3. Remove the shock and coil spring as an assembly.
4. Using a spring compressor, compress the spring until there is a clearance on both ends. Remove the suspension support center nut.
5. Remove the 2 retainers, cushion, suspension support and coil spring.

To install:

6. Using a compression tool, compress the coil spring. Do not compress the spring more than necessary and do not use an impact wrench.
7. Fit the lower end of the coil spring into the gap of the spring seat of the shock absorber.
8. Attach the spring and shock into the vehicle, tighten the mounting nuts to 47 ft. lbs. (64 Nm).
9. Attach the shock to the lower control arm, tighten to 101 ft. lbs. (135 Nm).
10. Install the wheel, tighten the lug nuts to 83 ft. lbs. (110 Nm).

Tacoma

➧ See Figures 30, 31 and 32

1. Loosen the lug nuts.
2. Elevate and safely support the vehicle. Make certain the jackstands are securely placed under the frame rails.
3. Use a floor jack to slightly jack and support the front axle housing.
4. Remove the front wheel.
5. Disconnect the shock absorber from the lower control arm as follows:
   a. Loosen the bolt, then remove the shock absorber lower nut.
   b. While lowering the lower control arm, remove the bolt then disconnect the shock.
6. Remove the shock mounting nuts and coil spring as an assembly.
7. Using a spring compressor, compress the coil until there is a clearance at both ends. Remove the suspension support center nut. Remove the suspension support and coil spring.
8. Remove the insulator from the suspension support.

To install:

9. Match the bolt of the suspension support with the cut out part of the insulator, install the insulator to the support.
10. Using the spring compressor, compress the spring and install the shock. Fit the lower end of the coil spring into the gap of the spring seat of the shock.
11. Install the suspension support rod. Temporarily tighten the new suspension support center nut. Position the support so that the line drawn between the 2 bolts would be parallel to the direction of the lower bushing.
12. Remove the compressor tool.
13. Check that the direction of the support again. Tighten the center nut to 22 ft. lbs. (29 Nm).
14. Attach the coil and shock assembly to the top portion of the engine compartment. Tighten the nuts to 47 ft. lbs. (64 Nm).
15. Attach the shock to the lower control arm, then tighten the mounting bolt to 101 ft. lbs. (135 Nm).
16. Attach the wheel, hand tighten the lug nuts.
17. Lower the vehicle, tighten the lug nuts.

Leaf Springs

REMOVAL & INSTALLATION

1989-90 Land Cruiser

1. Remove the wheels, then raise the front of the vehicle and support it on safety stands. Make certain the stands are placed under the frame rails.
2. Position a floor jack under the differential housing and lower it until there is no tension on the leaf springs.

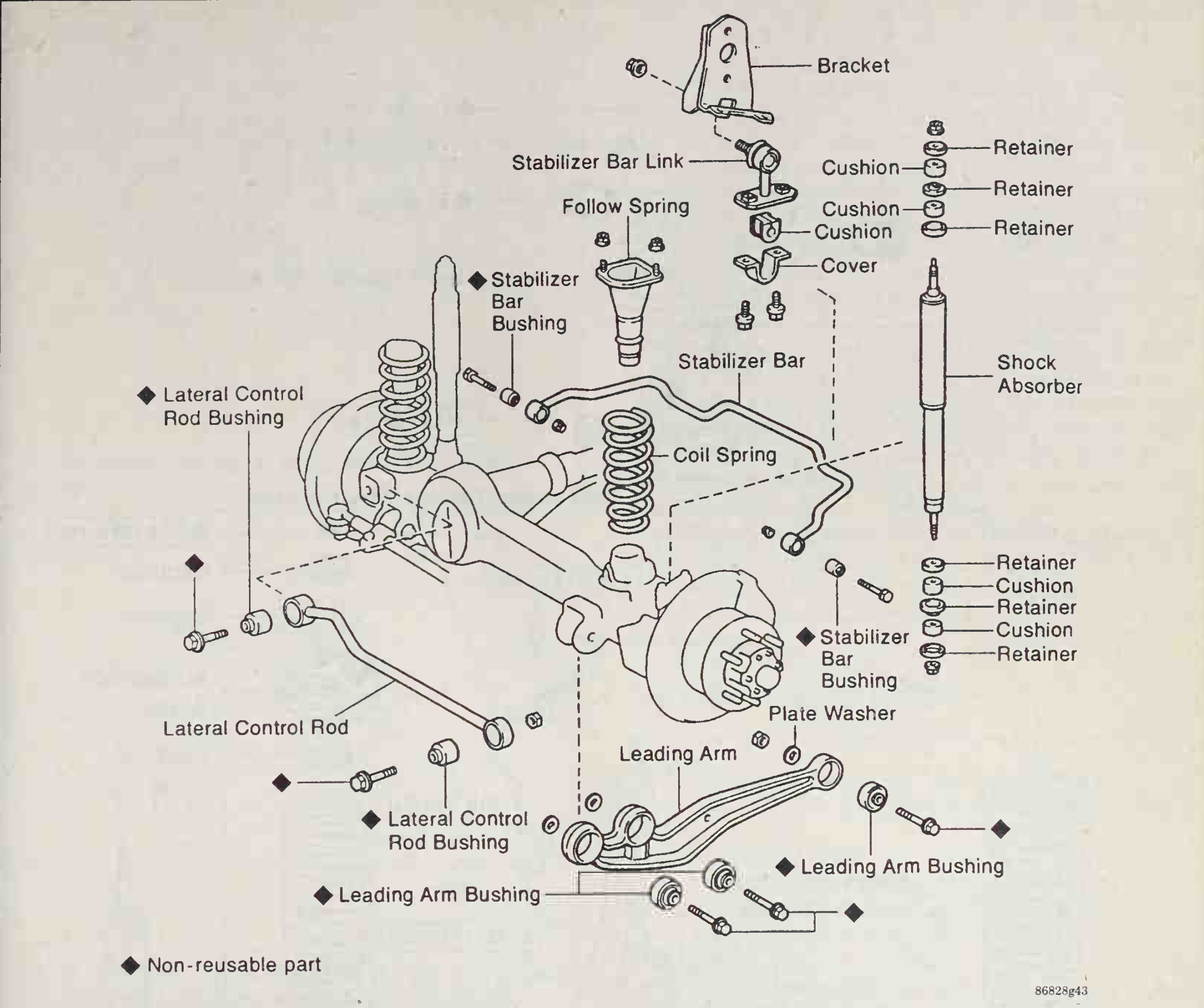

Bracket
Stabilizer Bar Link
Cushion
Retainer
Retainer
Follow Spring
Cushion
Cushion
Retainer
Cover
◆ Stabilizer Bar Bushing
Stabilizer Bar
Shock Absorber
◆ Lateral Control Rod Bushing
Coil Spring
◆
Retainer
Cushion
Retainer
Cushion
◆ Stabilizer Bar Bushing
Retainer
Lateral Control Rod
Plate Washer
Leading Arm
◆
◆ Lateral Control Rod Bushing
◆
◆ Leading Arm Bushing
◆ Leading Arm Bushing
◆
◆ Non-reusable part
86828g43

Fig. 28 Exploded view of the coil spring and associated components — Land Cruiser

3. Remove the shock absorber.
4. Remove the U-bolt mounting nuts, pull the spring set away and remove the U-bolts.
5. Remove the hanger and shackle pin mounting nuts. Remove the pins and then lift out the leaf spring.

➡It may be necessary to lower the jack under the axle housing to remove spring.

To install:

6. Insert the bushings into the frame and each end of the leaf. Position the spring, install the hanger pin and tighten the bolt to 17 ft. lbs. (24 Nm).
7. Finger-tighten the hanger pin nut and install the shackle pin. Install the plate and finger-tighten the nuts.
8. Insert the head of the center leaf spring bolt into the hole in the axle housing bracket and then install the U-bolts onto the leaf. Install the spring seat and nuts. Tighten the nuts to 105 ft. lbs. (142 Nm).

➡When tightening the U-bolts, the exposed length of each bolt below the nut must be the same for all 4 threaded ends.

9. Install the shock absorber.
10. Lower the truck and bounce it a few times to stabilize the suspension.
11. Tighten the hanger pin nut to 90 ft. lbs. (123 Nm). Tighten the shackle pin nut to 67 ft. lbs. (91 Nm).

Shock Absorbers

TESTING

The purpose of the shock absorber is simply to limit the motion of the spring during compression (bump) and rebound cycles. If the vehicle were not equipped with these motion

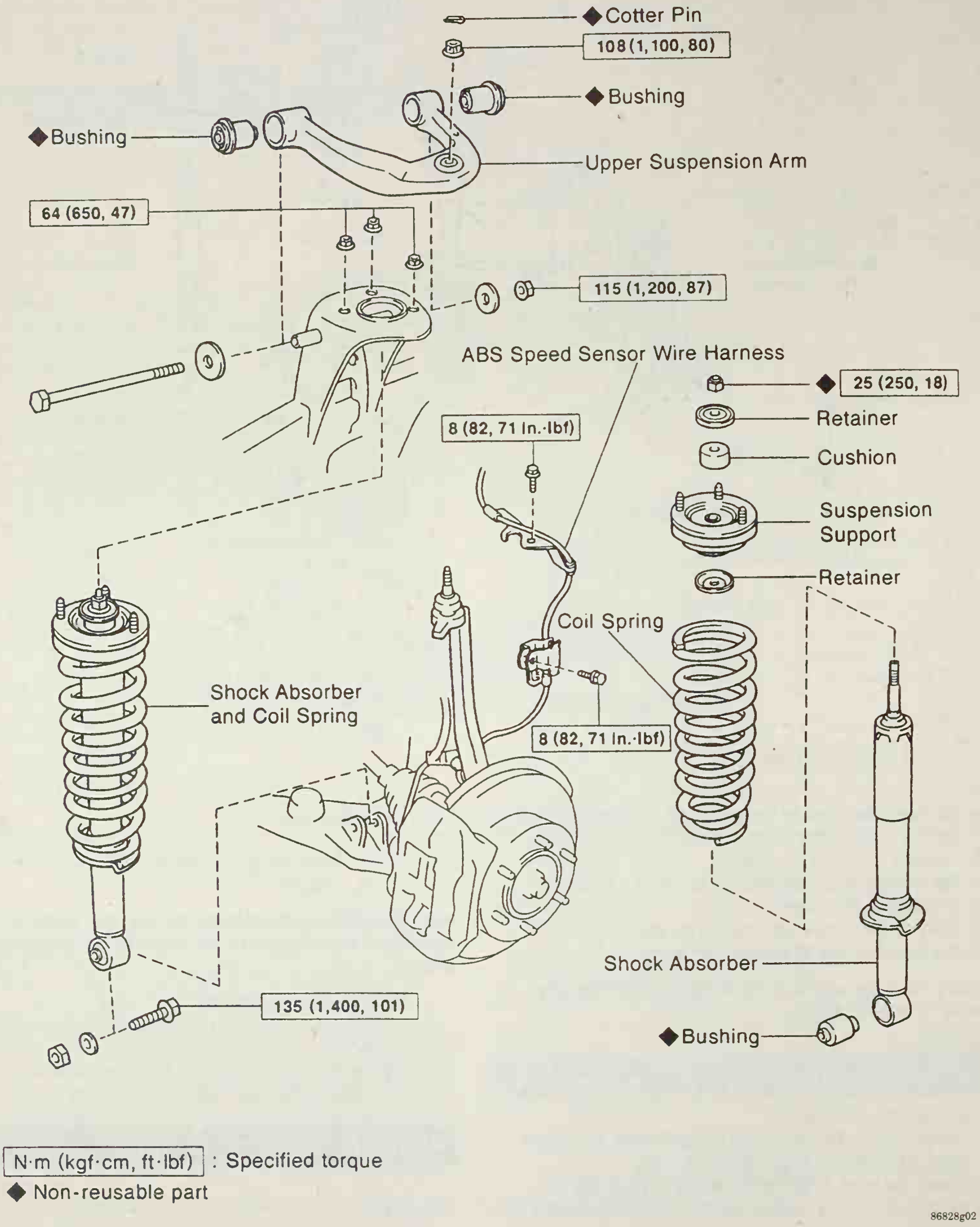

◆Cotter Pin
108 (1,100, 80)
◆Bushing
◆Bushing
Upper Suspension Arm
64 (650, 47)
115 (1,200, 87)
ABS Speed Sensor Wire Harness
◆ 25 (250, 18)
Retainer
8 (82, 71 In.·lbf)
Cushion
Suspension Support
Retainer
Coil Spring
Shock Absorber and Coil Spring
8 (82, 71 In.·lbf)
Shock Absorber
135 (1,400, 101)
◆Bushing
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g02

Fig. 29 Exploded view of the coil spring and related suspension components — 4Runner

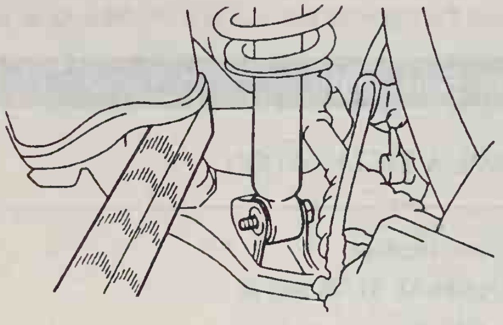


Fig. 30 Loosen the bolt at the bottom of the shock absorber

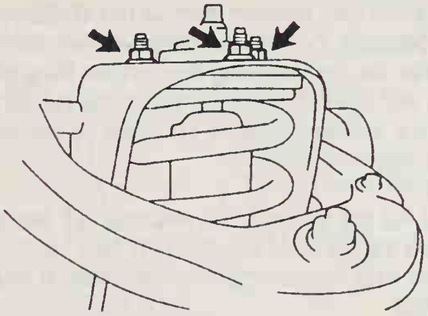


Fig. 31 The three nuts at the top of the coil spring and shock absorber assembly are accessed through the engine compartment

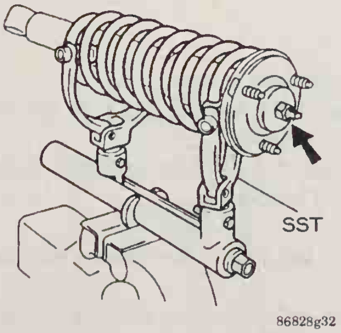


Fig. 32 A spring compressor is a must for this job; follow the manufacturer's instructions

dampers, the up and down motion of the vehicle would multiply until the vehicle was alternately trying to leap off the ground and to pound itself into the pavement.

Contrary to popular rumor, the shocks do not affect the ride height of the vehicle nor do they affect the ride quality except for limiting the pitch or bounce of the vehicle. These factors are controlled by other suspension components such as springs and tires. Worn shock absorbers can affect handling; if the front of the vehicle is rising or falling excessively, the "footprint" of the tires changes on the pavement and steering response is affected. The simplest test of the shock absorbers is simply to push down on one corner of the unladen vehicle and release it.

Observe the motion of the body as it is released. In most cases, it will come up beyond its original rest position, dip back below it and settle quickly to rest. This shows that the damper is slowing and controlling the spring action. Any tendency to excessive pitch (up-and-down) motion or failure to return to rest within 2-3 cycles is a sign of poor function within the shock absorber.

While each shock absorber can be replaced individually, it is recommended that they be changed as a pair (both front or both rear) to maintain equal response on both sides of the vehicle. Chances are quite good that if one has failed, its mate is weak also.

REMOVAL & INSTALLATION

1. Remove the hubcap and loosen the lug nuts.
2. Raise the front of the truck and support it with safety stands.
3. Remove the wheel.
4. Unfasten the double nuts at the top end of the shock absorber. Remove the cushions and cushion retainers.
5. Remove the lower through-bolt.
6. Remove the shock absorber.
7. Install the shock absorber and tighten the lower mounting nuts/bolt to the appropriate torque:
   - T100 and Tacoma — 101 ft. lbs. (137 Nm)
   - Land Cruiser — 51 ft. lbs. (69 Nm)
   - 1989-95 Pick-Up and 4Runner — 47 ft. lbs. (64 Nm)
   - 1996 4Runner — 101 ft. lbs. (137 Nm).
8. Tighten the upper mounting nut to 18 ft. lbs. (25 Nm).
9. Install the wheels and lower the truck.

INSPECTION

Once removed, the shock should be carefully inspected for any signs of leakage. Oil-filled shocks may have a light film of oil around the seal, resulting from normal breathing and air exchange. This should NOT be taken as a sign of failure, but any sign of thick or running oil definitely indicates failure. Gas filled shocks may also show some film at the shaft; if the gas has leaked out, the shock will have almost no resistance to motion.

Hold the shock firmly in each hand and compress it; compression should be reasonably even and smooth. Release the piston end; it should return smoothly and at an even pace.

Stretch the shock, checking again for smooth motion and any abnormal resistance.

DISPOSAL OF GAS-FILLED SHOCK ABSORBERS

The factory installed gas shocks found on some vehicles contain nitrogen. The gas is under pressure, even with the shock removed from the vehicle. To eliminate the possibility of explosion after disposal, the shock case must be drilled to release the gas.

Drill a 0.079-0.118 in. (2-3mm) hole at a point 1.18 in. (30mm) above the base of the shock case. Drill a second hole 1.97 in. (50mm) below the edge of the piston cover (with the shock compressed).

⁂CAUTION

Although nitrogen is non-toxic and non-flammable, the escaping gas may carry metal chips from the drill; always wear eye or full-face protection when drilling.

Once the gas is released, the shock absorber may be safely discarded.

Upper Ball Joint

REMOVAL & INSTALLATION

Tacoma and 4Runner

1. Remove the front wheel.
2. Remove the steering knuckle with the axle hub.
3. Separate the upper ball joint as follows:
   a. Remove the wire and boot.
   b. Using a snapring expander, remove the snapring.
   c. With a ball joint remover and a deep socket, remove the upper ball joint.

To install:

4. With the aid of the ball joint installer and a socket wrench, install the ball joint.
5. Using a snapring expander, install a new snapring.
6. Apply multi-purpose grease, then install a new boot. Fix it with a new wire.
7. Install the steering knuckle with the axle hub.
8. Install the front wheel, lower the vehicle and tighten the lug nuts.
9. Have the alignment checked at a reputable repair facility.

T100

1. Remove the front wheel.
2. Disconnect the upper ball joint from the steering knuckle.
3. Remove the upper ball joint 4 mounting nuts. Separate the ball joint from the upper control arm.

To install:

4. Attach the ball joint mounting nuts, tighten to 25 ft. lbs. (33 Nm).
5. Attach the ball joint to the steering knuckle.
6. Install the front wheel, lower the vehicle and tighten the lug nuts.
7. Have the alignment checked at a reputable repair facility.

Lower Ball Joint

REMOVAL & INSTALLATION

Tacoma and 4Runner

➧ See Figures 33, 34, 35 and 36

1. Remove the front wheel.
2. Support the lower control arm with a suitable jack.
3. Loosen the four bolts attaching the lower ball joint. Do not remove them. Remove the cotter pin and nut from the tie rod end. Throw out the old cotter pin. With special tool 09610-20012 or equivalent, disconnect the tie rod end from the steering knuckle.
4. Remove the cotter pin and nut from the lower ball joint. Discard the cotter pin.
5. With a ball joint remover such as tool 09628-62011 or equivalent, separate the ball joint from the lower control arm.
6. Remove the four mounting bolts. When lifting the upper control arm and steering knuckle, remove the ball joint. After the ball joint is removed, support the upper control arm and knuckle securely.

To install:

7. Install the ball joint with the mounting nut and bolts.
8. Tighten the nut to 112 ft. lbs. (152 Nm) on the Tacoma, or 105 ft. lbs. (142 Nm) on the 4Runner. Install a new cotter pin in the hole.
9. Attach the tie rod end tightening the nut to 66 ft. lbs. (90 Nm). Install a new cotter pin.
10. Tighten the lower ball joint set bolts, 59 ft. lbs. (80 Nm) 4Runner, 83 ft. lbs. (113 Nm).
11. Remove the jack slowly, making sure everything is secure and in place.
12. Install the wheel, lower the vehicle and tighten the lug nuts.
13. Check the ABS speed sensor signal.
14. Have the alignment checked at a reputable repair facility.

T100

1. Remove the front wheel.
2. Disconnect the lower ball joint from the steering knuckle. Remove the cotter pin and nut.
3. With the aid of a ball joint separator, disconnect the joint from the steering knuckle.

To install:

4. Attach the ball joint to the knuckle with the special installer tool.
5. Attach the ball joint to the steering knuckle, tighten the nut to 105 ft. lbs. (142 Nm). Use a new cotter pin.
6. Install the front wheel, lower the vehicle and tighten the lug nuts.
7. Have the alignment checked at a reputable repair facility.

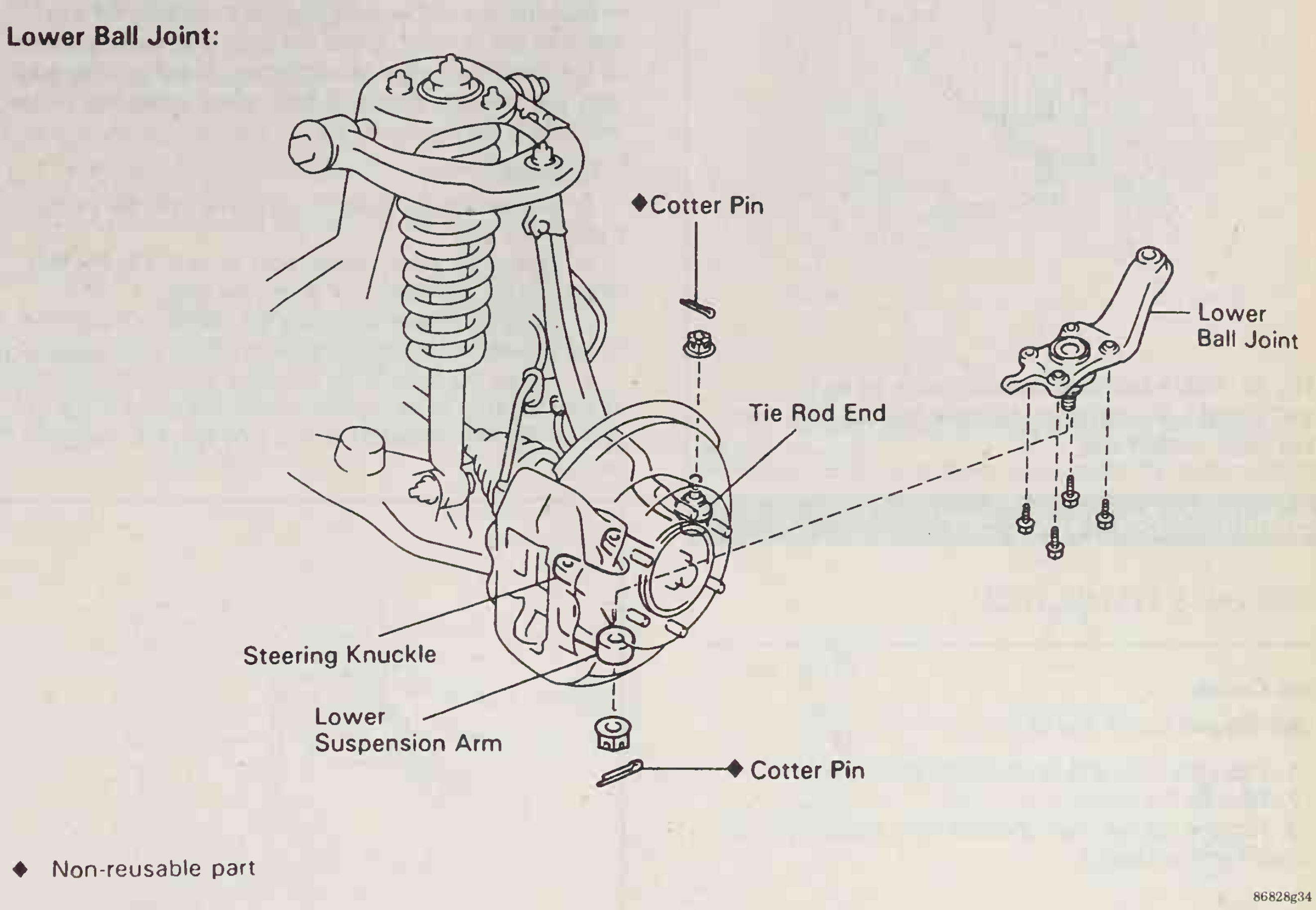

Lower Ball Joint:
◆Cotter Pin
Lower Ball Joint
Tie Rod End
Steering Knuckle
Lower Suspension Arm
◆Cotter Pin
◆ Non-reusable part
86828g34

Fig. 33 Exploded view of the lower control arm — Tacoma shown

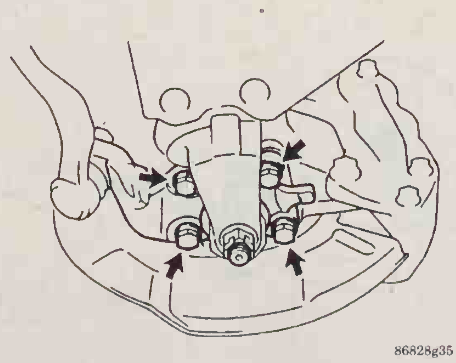


Fig. 34 Loosen, but do not yet remove these four bolts

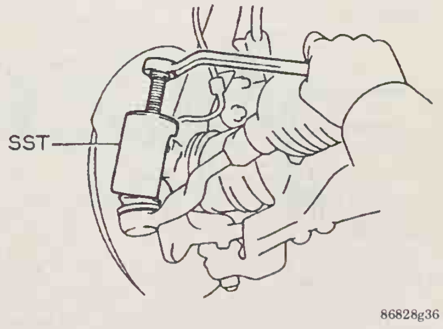

SST
86828g36

Fig. 35 With special tool 09610-20012 or equivalent, disconnect the tie rod end from the steering knuckle

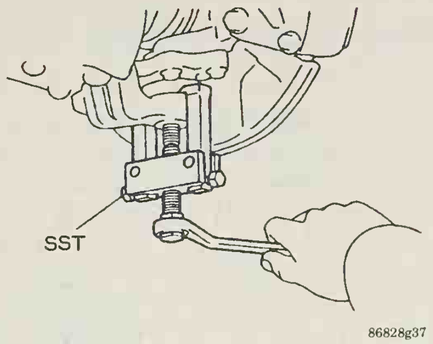


Fig. 36 With a ball joint remover, such as tool 09628-62011 or equivalent, separate the ball joint from the lower control arm

Stabilizer Bar (Sway Bar)

REMOVAL & INSTALLATION

Land Cruiser

➧ **See Figures 37, 38 and 39**

1. Raise the truck and support it on safety stands.
2. Remove the wheels.
3. Remove the nut, then disconnect the stabilizer bar with the link from the bracket.
4. Disconnect the bar from the axle housing. Remove the stabilizer bar. Remove the 2 bolts and remove the bracket from the bar.

➡Examine the rubber bushings very carefully for any splits or deformation. Clean the inner and outer surfaces of the bushings before reinstallation. Failed or dirty bushings can create a chorus of odd noises under the vehicle, particularly during cornering.

To install:

5. Reassemble the cushions and cover onto the painted mark on the bar.
6. Tighten the bar-to-bracket bolts to 13 ft. lbs. (18 Nm). Mount the bar, tightening the fittings just snug.
7. Install the wheels and lower the vehicle to the ground. Bounce the front end several times to stabilize the suspension.
8. Tighten the bolts at the axle tube to 19 ft. lbs. (25 Nm). Tighten the nuts at the top of the small link to 13 ft. lbs. (18 Nm) on 1991-93 models 76 ft. lbs. (103 Nm) on 1994-96 models.

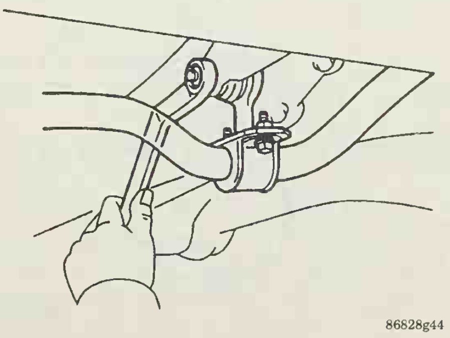


Fig. 37 Remove the nut, then disconnect the stabilizer bar and link from the bracket

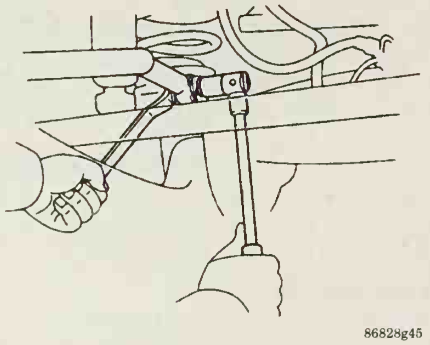


Fig. 38 Two wrenches will be needed to remove the through-bolt

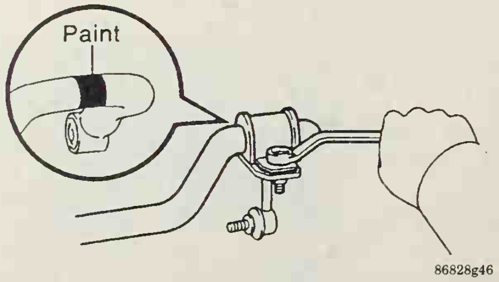


Fig. 39 Reassemble the cushions and cover over the painted mark on the bar

9. Have the alignment checked at a reputable repair facility.

Tacoma, T100 and 4Runner

➧ See Figures 40, 41, 42 and 43

1. Remove the front wheels.
2. Disconnect the stabilizer bar links as follows:
   a. Remove the nuts and disconnect the stabilizer bar links from the lower control arm.
   b. Hold the link with a wrench, then remove the nut, retainers, cushions and link.
3. Remove the bolts and stabilizer bar with cushions and brackets.

To install:

4. Place the stabilizer bar into position, then install both the bar cushions and brackets to the frame. Temporarily install the bolts. Tighten to 19-22 ft. lbs. (25-29 Nm).
5. Hold the stabilizer bar link with a wrench, then install the link onto the lower control arm with a new nut. Tighten the nut to 14-19 ft. lbs. (19-25 Nm).

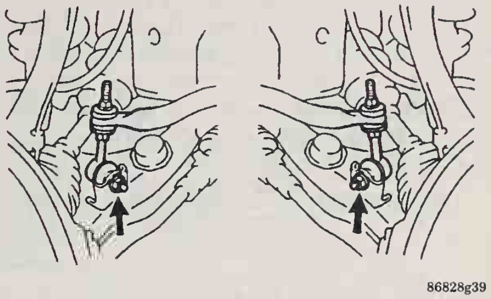


Fig. 41 Remove these two nuts attaching the stabilizer links to the bar

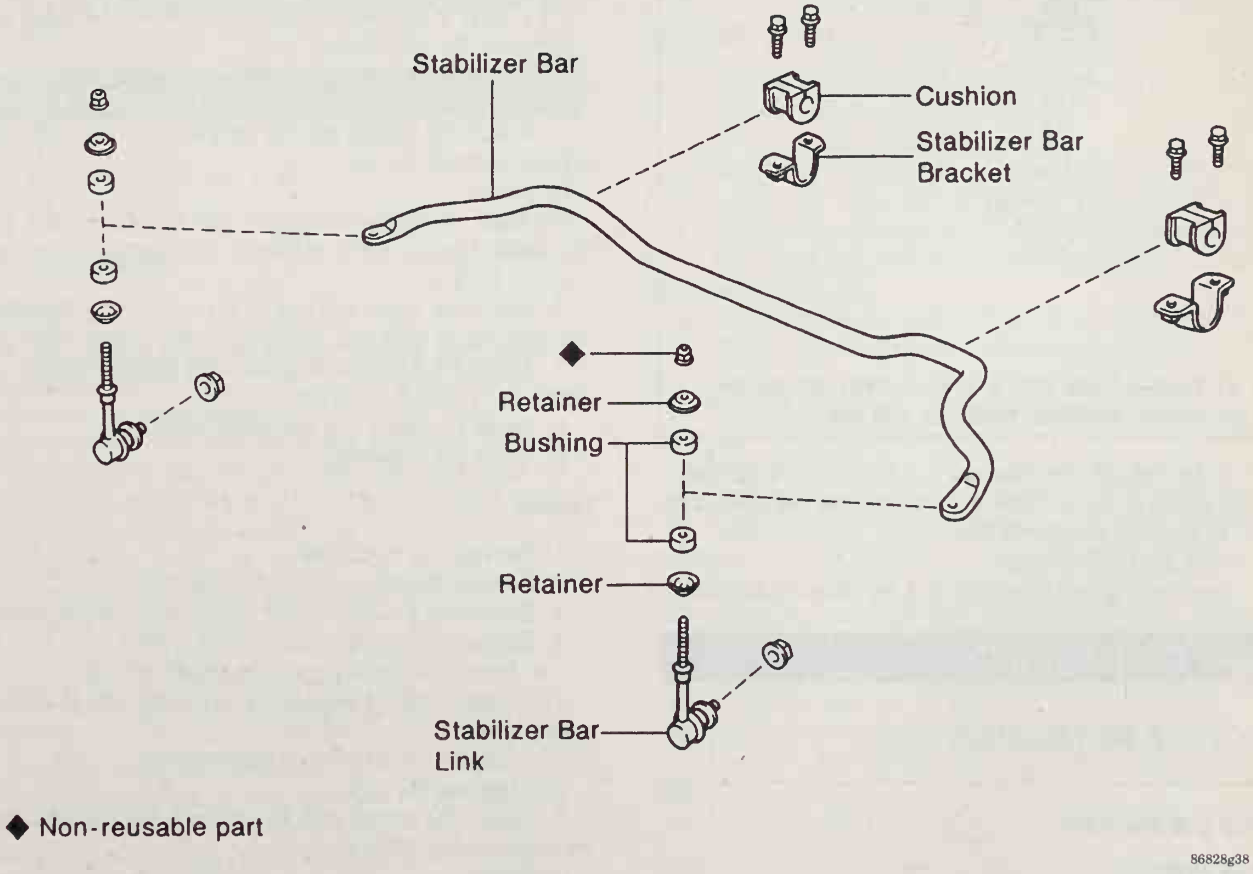

Stabilizer Bar
Cushion
Stabilizer Bar Bracket
◆
Retainer
Bushing
Retainer
Stabilizer Bar Link
◆ Non-reusable part
86828g38

Fig. 40 Exploded view of the sway bar and associated components

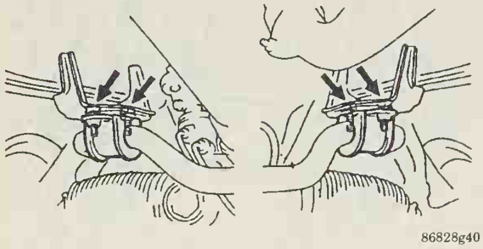


Fig. 42 The two brackets which help position the bar are secured by four mounting bolts

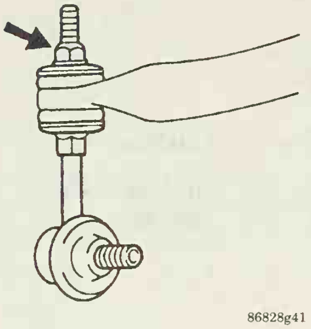


Fig. 43 Hold the link with a wrench, then remove the nut (at arrow), retainers, cushions and link

6. On models with the links using a hexagon wrench, connect the stabilizer bar on both sides to the links with new nuts, tighten to 55-70 ft. lbs. (69-95 Nm).
7. Install the front wheels.
8. Have the alignment checked at a reputable repair facility.

Upper Control Arm

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Raise the truck and support it on safety stands. Remove the wheels.
2. Remove the torsion bar.
3. Remove the cotter pin and nut and press the upper ball joint out of the steering knuckle.
4. Remove the upper shock absorber mounting nut. Do not disconnect the lower end of the shock.
5. Disconnect the intermediate shaft from the steering gear housing. Remove the 2 nuts and bolt and lift out the upper arm.

To install:

6. Install the upper arm and tighten the mounting bolts to 131 ft. lbs. (178 Nm).
7. Connect the intermediate shaft to the steering gear housing.
8. Install a new upper shock absorber nut. Tighten it to 18 ft. lbs. (25 Nm).
9. Attach the upper ball joint to the steering knuckle, then tighten the nut to 105 ft. lbs. (142 Nm). Install a new cotter pin.
10. Install the torsion bar.
11. Install the wheels and lower the vehicle.
12. Have the alignment checked and adjusted at a reputable repair facility.

1996 MODELS

1. Remove the shock and coil spring assembly.
2. Disconnect the ABS speed sensor wire harness clamp.
3. Disconnect the upper ball joint as follows:
   a. Remove the cotter pins and loosen the nut.
   b. Using a ball joint separator, disconnect the upper ball joint from the control arm.
   c. Support the steering knuckle securely.
   d. Remove the nut.
4. Detach the control arm, by removing the nut, bolt, washers and lowering the arm.

To install:

5. Attach the upper control arm with the washer, bolt and nut. Make sure the arm is stabilized, then tighten the nut to 87 ft. lbs. (115 Nm).
6. Attach the upper ball joint to the control arm. Tighten the mounting nut to 80 ft. lbs. (105 Nm). Install a new cotter pin.
7. Attach the ABS speed sensor wire harness clamp, tighten to 71 inch lbs. (8 Nm).
8. Install the shock and coil spring assembly.
9. Check the alignment.

Tacoma

1. Remove the front wheel.
2. Remove the shock and coil spring assembly.
3. Disconnect the ABS speed sensor wire harness clamp.
4. Disconnect the upper ball joint as follows:
   a. Remove the cotter pins and loosen the nut.
   b. Using a ball joint separator, disconnect the upper ball joint from the control arm.
   c. Support the steering knuckle securely.
   d. Remove the nut.
5. Detach the control arm, by removing the nut, bolt, washers and lowering the arm.

To install:

6. Attach the upper control arm with the washer, bolt and nut. Make sure the arm is stabilized, then tighten the nut to 87 ft. lbs. (115 Nm).
7. Attach the upper ball joint to the control arm. Tighten the mounting nut to 80 ft. lbs. (105 Nm). Install a new cotter pin.

8. Attach the ABS speed sensor wire harness clamp, tighten to 71 inch lbs. (8 Nm).
9. Install the shock and coil spring assembly.
10. Check the alignment.

T100

1. Raise the truck and support it on safety stands. Remove the wheels.
2. Disconnect the ABS speed sensor wire harness clamp.
3. Remove the torsion bar.
4. Remove upper ball joint out of the steering knuckle as follows:
    a. Support the lower control arm with a suitable jack.
    b. Remove the nuts, then disconnect the upper control arm from the steering knuckle.
    c. Remove the bolts, then remove the upper control arm from thew frame.

To install:

5. Install the upper arm and tighten the mounting bolts to 131 ft. lbs. (178 Nm).
6. Connect the upper ball joint to the steering knuckle, then tighten the nut to 25 ft. lbs. (33 Nm).
7. Install the torsion bar.
8. Install the wheel(s) and lower the vehicle.
9. Have the alignment checked and adjusted at a reputable repair facility.

Lower Control Arm

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Raise the front of the truck and support it with safety stands. Remove the wheels.
2. Remove the shock absorber.
3. Disconnect the stabilizer bar at the lower arm.
4. Disconnect the lower ball joint from the control arm.
5. Paint matchmarks on the front and rear adjusting cams, remove them and lift out the control arm.

To install:

6. Install the lower arm and adjusting cams to the frame. Temporarily tighten the nuts.
7. Connect the ball joint to the arm. Tighten the nut to 105 ft. lbs. (142 Nm) and install a new cotter pin.
8. Connect the stabilizer bar, then tighten the nuts to 19 ft. lbs. (25 Nm).
9. Install the shock absorber.
10. Install the wheels and lower the truck. Bounce the truck several times to set the suspension.
11. Align the matchmarks on the adjusting cams and tighten the nuts to 145 ft. lbs. (196 Nm).
12. Have the alignment checked at a reputable repair facility.

1996 MODELS

▶ See Figures 44, 45 and 46

1. Remove the front wheel.
2. Remove the steering gear assembly.
3. Disconnect the stabilizer bar link.
4. Disconnect the shock absorber from lower control arm.
5. Support the upper control and steering knuckle securely.
6. Remove the cotter pin and nut from the lower ball joint.
7. With a ball joint remover, disconnect the ball joint from thew lower control arm.
8. Place matchmarks on the front and rear adjusting cams.
9. Remove the 2 bolts, nuts, adjusting cams and lower control arm.
10. Remove the spring bumpers with a special tool 09922-10010 or its equivalent.

To install:

11. Attach the spring bumpers, tighten to 17 ft. lbs. (23 Nm).
12. Attach the lower control arm, placing it in the appropriate position with the matchmarks. Tighten the arm to 96 ft. lbs. (130 Nm).
13. Attach the lower ball joint with the correct tool, tighten the nut to 105 ft. lbs. (142 Nm).
14. Attach the shock absorber to the lower control arm.
15. Install the stabilizer bar link.
16. Install the steering gear assembly.
17. Install the front wheel, lower the vehicle. Tighten the lug nuts.
18. Have the alignment checked at a reputable repair facility.

Tacoma

1. Remove the front wheel.
2. Remove the steering gear assembly.
3. Disconnect the stabilizer bar link.
4. Disconnect the shock absorber from lower control arm.
5. Support the upper control and steering knuckle securely.
6. Remove the cotter pin and nut from the lower ball joint.
7. With a ball joint remover, disconnect the ball joint from thew lower control arm.
8. Place matchmarks on the front and rear adjusting cams.
9. Remove the 2 bolts, nuts, adjusting cams and lower control arm.
10. Remove the spring bumpers with a special tool 09922-10010 or its equivalent.

To install:

11. Attach the spring bumpers, tighten to 17 ft. lbs. (23 Nm).
12. Attach the lower control arm, placing it in the appropriate position with the matchmarks. Tighten the arm to 96 ft. lbs. (130 Nm).
13. Attach the lower ball joint with the correct tool, tighten the nut to 112 ft. lbs. (152 Nm).
14. Attach the shock absorber to the lower control arm.
15. Install the stabilizer bar link.
16. Install the steering gear assembly.
17. Install the front wheel, lower the vehicle. Tighten the lug nuts.
18. Have the alignment checked at a reputable repair facility.

T100

1. Raise the front of the truck and support it with safety stands. Remove the wheels.
2. Remove the shock absorber from the lower control arm.
3. Disconnect the stabilizer bar at the lower arm.
4. Disconnect the lower ball joint from the control arm. Remove the cotter pin, then discard. Loosen the nut.

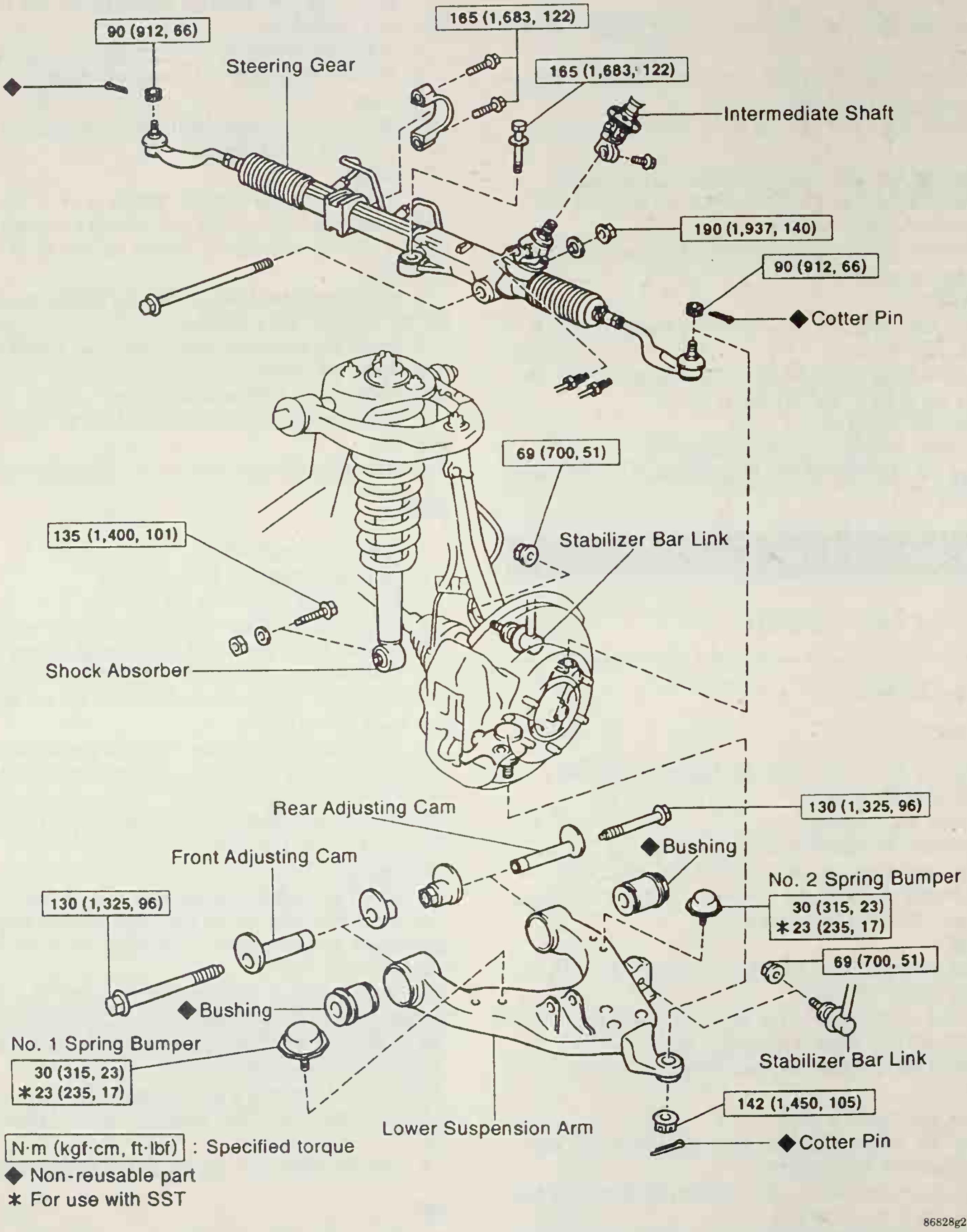

90 (912, 66)
165 (1,683, 122)
Steering Gear
165 (1,683, 122)
Intermediate Shaft
◆
190 (1,937, 140)
90 (912, 66)
◆Cotter Pin
69 (700, 51)
135 (1,400, 101)
Stabilizer Bar Link
Shock Absorber
Rear Adjusting Cam
130 (1,325, 96)
◆Bushing
Front Adjusting Cam
No. 2 Spring Bumper
30 (315, 23)
✱23 (235, 17)
130 (1,325, 96)
69 (700, 51)
◆Bushing
No. 1 Spring Bumper
30 (315, 23)
✱23 (235, 17)
Stabilizer Bar Link
142 (1,450, 105)
Lower Suspension Arm
◆Cotter Pin
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
✱ For use with SST
86828g20

Fig. 44 Exploded view of the lower control arm and associated components — 1996 4Runner

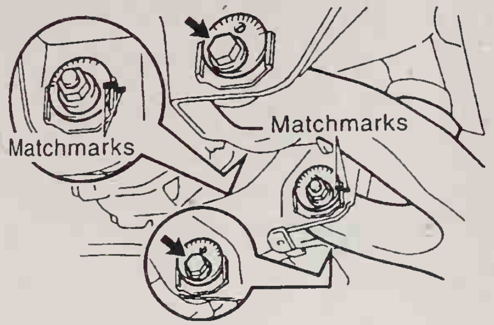


Fig. 45 Place matchmarks on the front and rear adjusting cams

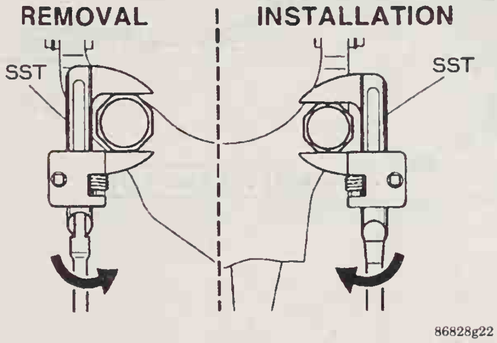


Fig. 46 Remove the spring bumpers with special tool 09922-10010 or its equivalent

5. Paint matchmarks on the front and rear adjusting cams, remove them and lift out the control arm.

To install:

6. Install the lower arm and adjusting cams to the frame. Temporarily tighten the nuts.
7. Connect the ball joint to the arm. Tighten the nut to 105 ft. lbs. (142 Nm) and install a new cotter pin.
8. Connect the stabilizer bar and tighten the nuts.
9. Install the shock absorber to the lower control arm, tighten to 101 ft. lbs. (137 Nm).
10. Install the wheels and lower the truck. Bounce the truck several times to set the suspension.
11. Align the matchmarks on the adjusting cams and tighten the nuts to 145 ft. lbs. (196 Nm).
12. Have the alignment checked at a reputable repair facility.

Leading Arm

REMOVAL & INSTALLATION

Land Cruiser

➧ See Figures 47, 48 and 49

1. Raise and safely support the vehicle. Loosen the lug nuts.
2. Remove the front wheel.
3. Remove the leading arm bolt, plate washer and nut on the frame side.
4. Remove the 2 bolts and nut from the arm on the axle side. Lower the arm.

To install:

5. Attach the leading arm on the axle housing side, tighten the bolts to 127 ft. lbs. (171 Nm).
6. Attach the leading arm on the frame side, tighten the bolts to 130 ft. lbs. (177 Nm).
7. Install the wheel and hand-tighten the lug nuts.
8. Lower the vehicle then wrench tighten the lug nuts.
9. Have the alignment checked at a reputable repair facility.

Lateral Control Rod

REMOVAL & INSTALLATION

➧ See Figure 50

1. Raise and safely support the vehicle. Loosen the lug nuts.
2. Remove the front wheel.
3. Disconnect the lateral control rod as follows:
   a. Remove the bolt that attaches the rod to the axle housing.
   b. Remove the nut, bolt and rod from the frame side.

To install:

4. Attach the nut, bolt and rod to the frame side, and tighten to 127 ft. lbs. (171 Nm).
5. Attach the bolt that connects the rod to the axle housing, tighten to 127 ft. lbs. (171 Nm).
6. Install the wheel.
7. Lower the vehicle, tighten the lug nuts.
8. Have the alignment checked at a reputable repair facility.

Steering Knuckle and Spindle

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

1. Raise the front of the truck and support it on safety stands. Remove the wheels.

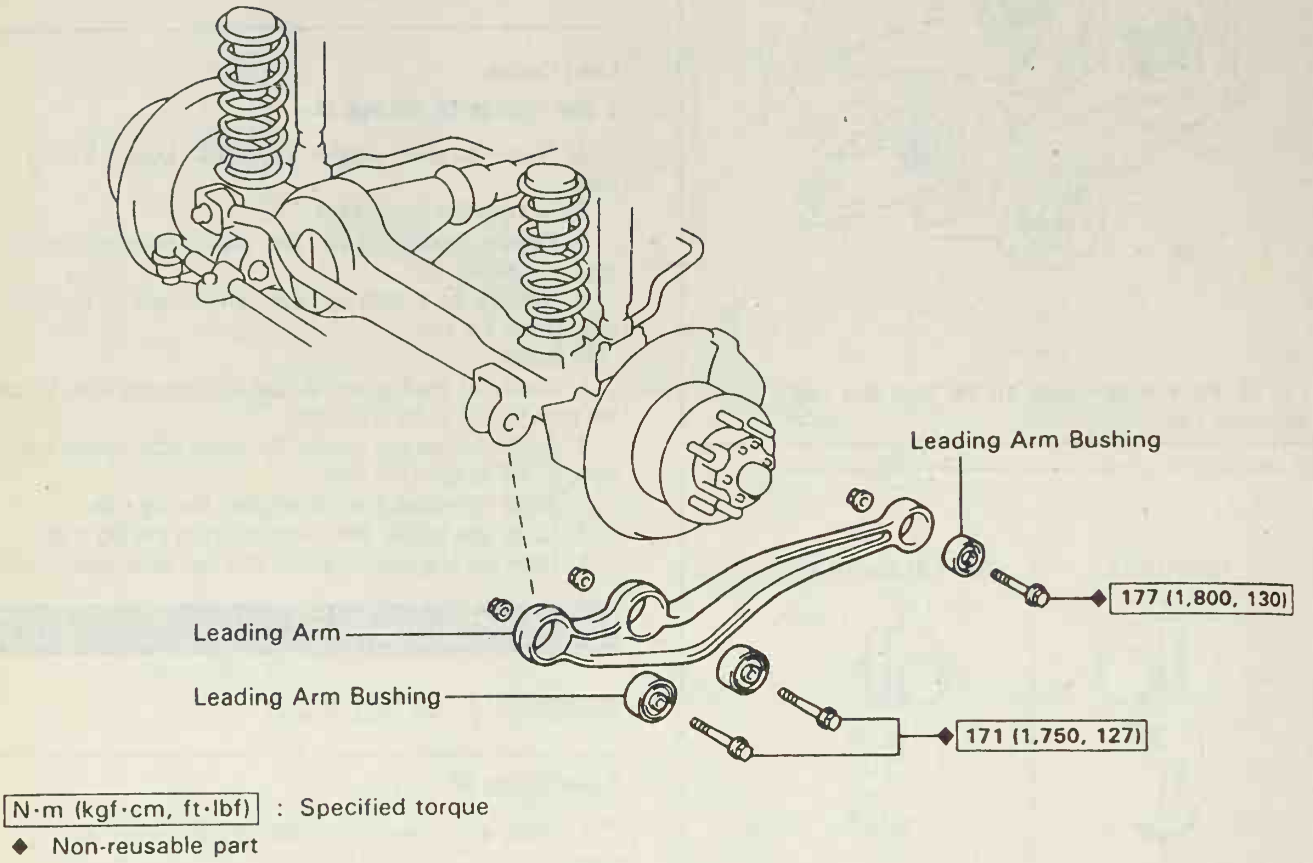

Leading Arm Bushing
177 (1,800, 130)
Leading Arm
Leading Arm Bushing
171 (1,750, 127)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g50

Fig. 47 Exploded view of the leading arm and related components — Land Cruiser

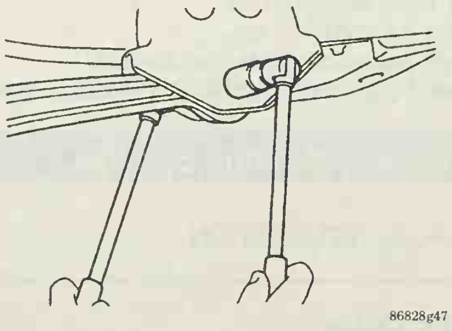


Fig. 48 Remove the bolts on the frame side of the vehicle for the leading arm

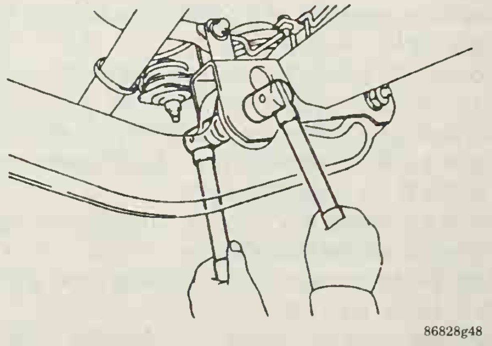


Fig. 49 The axle housing-to-leading arm side has two bolts to remove

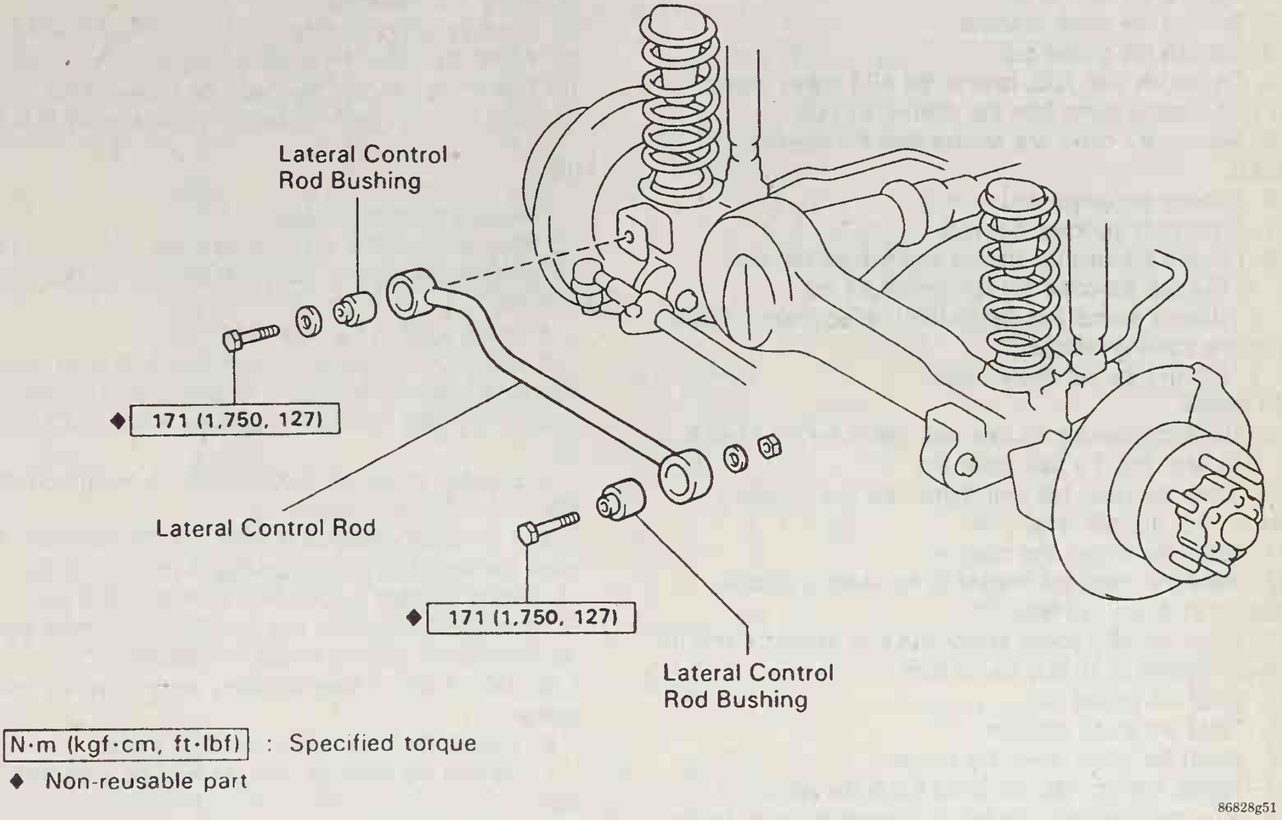

Lateral Control Rod Bushing
◆ 171 (1,750, 127)
Lateral Control Rod
◆ 171 (1,750, 127)
Lateral Control Rod Bushing
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g51

Fig. 50 Exploded view of the lateral control rod

2. Remove the brake caliper. Remove the brake disc and front axle hub.

⁂CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

3. Remove the dust cover (splash shield) and oil seal.
4. Disconnect the knuckle arm at the steering knuckle.
5. Disconnect the shock absorber at the lower control arm.
6. Disconnect the stabilizer bar at the lower control arm.
7. Remove the snapring and spacer from the end of the knuckle spindle.
8. Remove the cotter pin and nut from the upper ball joint. Use a ball joint separator to disconnect it from the knuckle.
9. Remove the 4 bolts and disconnect the lower ball joint from the knuckle.
10. Press down on the lower control arm and lift out the steering knuckle.

To install:

11. Coat the splines of the axle shaft with grease, press down on the lower control arm and slide the knuckle over the axle shaft and into position.
12. Attach the lower ball joint to the knuckle, then tighten the 4 bolts to 43 ft. lbs. (58 Nm).
13. Attach the upper ball joint to the knuckle, then tighten the nut to 105 ft. lbs. (142 Nm). Install a new cotter pin.
14. Install the spacer and snapring to the end of the axle shaft.
15. Connect the stabilizer bar and the shock absorber to the lower arm.
16. Connect the knuckle arm to the steering knuckle, then tighten the bolt to 135 ft. lbs. (183 Nm).
17. Install the dust cover with a new oil seal and tighten the bolt to 13 ft. lbs. (18 Nm).
18. Install the brake disc and brake caliper.
19. Install the wheels. Lower the vehicle to the ground.
20. Bleed the brakes.

21. Have the alignment checked at a reputable repair facility.

4Runner

1996 MODELS

1. Remove the front wheel.
2. Remove the shock absorber.
3. Remove the grease cap.
4. On models with ABS, remove the ABS speed sensor and wire harness clamp from the steering knuckle.
5. Remove the brake line bracket from the steering knuckle.
6. Remove the caliper and rotor.
7. Disconnect the lower ball joint.
8. Remove the steering knuckle with hub as follows:
   a. Remove the cotter pin and loosen the nut.
   b. Using a special tool 09950-40010 or equivalent, disconnect the steering knuckle.
   c. Remove the nut and knuckle.

To install:

9. Attach the steering knuckle and tighten the nut to 80 ft. lbs. (108 Nm). Install a new cotter pin.
10. Attach the lower ball joint, tighten the four mounting bolts to 59 ft. lbs. (80 Nm).
11. Attach the caliper and rotor.
12. Install the brake line bracket to the steering knuckle, tighten to 21 ft. lbs. (28 Nm).
13. Attach the ABS speed sensor and wire harness clamp if removed, tighten to 71 inch lbs. (8 Nm).
14. Install the grease cap.
15. Install the shock absorber.
16. Attach the wheel, lower the vehicle.
17. Tighten the lug nuts, the bleed the brake system.
18. Have the alignment checked at a reputable repair facility.

Tacoma

➧ See Figure 51

1. Remove the front wheel.
2. Remove the shock absorber.
3. Disconnect the driveshaft as follows:
   a. Without a freewheeling hub, use a flat bladed tool to remove the grease cap.
   b. Remove the cotter pin and lock cap.
   c. Have an assistant apply the brakes, then remove the locknut.
   d. With free wheeling hubs, remove the free wheel hub.
   e. Using a snapring expander, removed the snapring.
   f. Remove the spacer.
4. On models with ABS, remove the ABS speed sensor and wire harness clamp from the steering knuckle.
5. Remove the caliper and rotor.
6. Disconnect the lower ball joint.
7. Remove the steering knuckle with hub as follows:
   a. Remove the cotter pin and loosen the nut.
   b. Using a special tool 09950-40010 or equivalent, disconnect the steering knuckle.
   c. Remove the nut and knuckle.

To install:

8. Attach the steering knuckle and tighten the nut to 80 ft. lbs. (108 Nm). Install a new cotter pin.
9. Attach the lower ball joint, tighten the four mounting bolts to 59 ft. lbs. (80 Nm).
10. Attach the caliper and rotor.
11. Attach the ABS speed sensor and wire harness clamp if removed, tighten to 71 inch lbs. (8 Nm).
12. Attach the driveshaft.
13. Install the shock absorber.
14. Attach the wheel, lower the vehicle.
15. Tighten the lug nuts, the bleed the brake system.
16. Have the alignment checked at a reputable repair facility.

T100

1. Remove the front wheels.
2. Remove the caliper and front axle hub.
3. Measure the steering knuckle bushing thrust clearance as follows:
   a. Install a bolt in the drive shaft.
   b. Using a feeler gauge, measure the drive shaft thrust clearance between the steering knuckle outside bushing and spacer, by pulling the bolt and applying a load of 22 lb. (98 N).
   c. Standard clearance: 0.0039-0.0197 in. (0.10-0.50mm). Maximum 0.039 in. (1.0mm).
   d. If the thrust clearance is more than the maximum, replace the steering knuckle outside and inside bushings.
4. Detach the front shock from the lower control arm.
5. Separate the stabilizer bar from the lower control arm.
6. Remove the steering knuckle as follows:
   a. Using a pair of snapring pliers, remove the ring and spacer.
   b. Support the lower control arm with a jack.
   c. Remove the cotter pin and nut from the upper ball joint.
   d. Using a ball joint separator, detach the joint from the knuckle.
   e. Remove the bolts from the lower ball joint, then disconnect the knuckle from the joint.
   f. Push down the lower control arm, then remove the knuckle. Be careful not to damage the seal.

To install:

7. Install the knuckle as follows:
   a. Apply synthetic oil and lithium soap base chassis grease NLGI No. 1 or equivalent to the driveshaft.
   b. Push down on the lower control arm, then install the steering knuckle.
   c. Connect the lower ball joint to the steering knuckle, tighten the nut to 105 ft. lbs. (142 Nm).
   d. Install a new cotter pin.
   e. Install a spacer to the driveshaft.
   f. Using a pair of snapring pliers, install the ring.

➡If you replace the knuckle bushing, recheck the clearance of the driveshaft thrust.

   g. Using a feeler gage, measure the driveshaft thrust clearance between the knuckle and the outside bushing and spacer, by pulling the bolt and applying a load of 22 lbs. (98 N).
   h. Standard clearance should be 0.0039-0.0197 in. (0.10-0.50mm).
   i. If the clearance is not within specifications, replace the spacer.

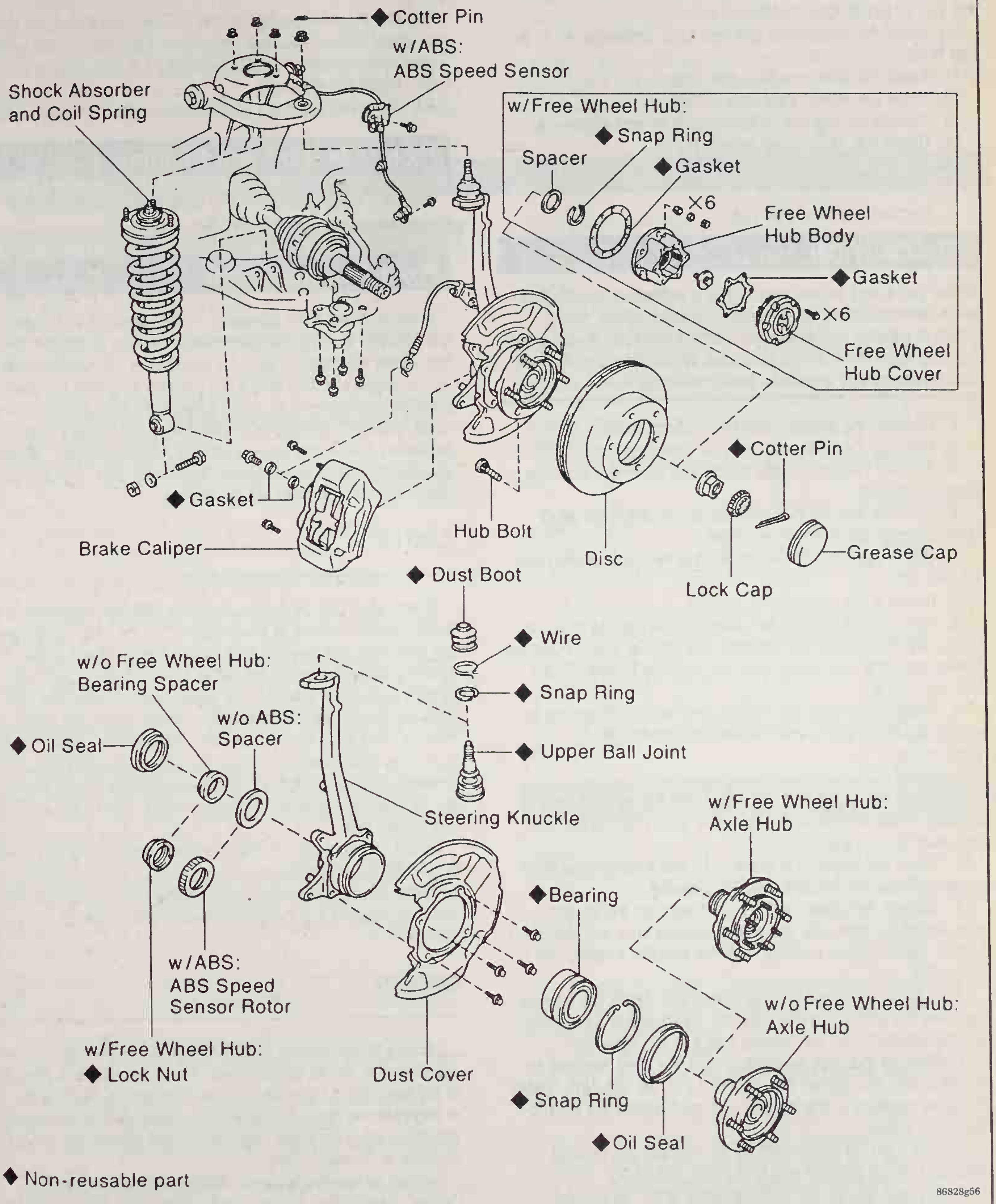

◆ Cotter Pin
w/ABS:
ABS Speed Sensor
Shock Absorber
and Coil Spring
w/Free Wheel Hub:
◆ Snap Ring
Spacer
◆ Gasket
×6
Free Wheel
Hub Body
◆ Gasket
×6
Free Wheel
Hub Cover
◆ Cotter Pin
◆ Gasket
Brake Caliper
Hub Bolt
Disc
Grease Cap
Lock Cap
◆ Dust Boot
◆ Wire
w/o Free Wheel Hub:
Bearing Spacer
◆ Snap Ring
w/o ABS:
Spacer
◆ Oil Seal
◆ Upper Ball Joint
Steering Knuckle
w/Free Wheel Hub:
Axle Hub
◆ Bearing
w/ABS:
ABS Speed
Sensor Rotor
w/o Free Wheel Hub:
Axle Hub
w/Free Wheel Hub:
◆ Lock Nut
Dust Cover
◆ Snap Ring
◆ Oil Seal
◆ Non-reusable part
86828g56

Fig. 51 Exploded view of the steering knuckle and hub — Tacoma shown

21. Have the alignment checked at a reputable repair facility.

4Runner

1996 MODELS

1. Remove the front wheel.
2. Remove the shock absorber.
3. Remove the grease cap.
4. On models with ABS, remove the ABS speed sensor and wire harness clamp from the steering knuckle.
5. Remove the brake line bracket from the steering knuckle.
6. Remove the caliper and rotor.
7. Disconnect the lower ball joint.
8. Remove the steering knuckle with hub as follows:
   a. Remove the cotter pin and loosen the nut.
   b. Using a special tool 09950-40010 or equivalent, disconnect the steering knuckle.
   c. Remove the nut and knuckle.

To install:

9. Attach the steering knuckle and tighten the nut to 80 ft. lbs. (108 Nm). Install a new cotter pin.
10. Attach the lower ball joint, tighten the four mounting bolts to 59 ft. lbs. (80 Nm).
11. Attach the caliper and rotor.
12. Install the brake line bracket to the steering knuckle, tighten to 21 ft. lbs. (28 Nm).
13. Attach the ABS speed sensor and wire harness clamp if removed, tighten to 71 inch lbs. (8 Nm).
14. Install the grease cap.
15. Install the shock absorber.
16. Attach the wheel, lower the vehicle.
17. Tighten the lug nuts, the bleed the brake system.
18. Have the alignment checked at a reputable repair facility.

Tacoma

See Figure 51

1. Remove the front wheel.
2. Remove the shock absorber.
3. Disconnect the driveshaft as follows:
   a. Without a freewheeling hub, use a flat bladed tool to remove the grease cap.
   b. Remove the cotter pin and lock cap.
   c. Have an assistant apply the brakes, then remove the locknut.
   d. With free wheeling hubs, remove the free wheel hub.
   e. Using a snapring expander, removed the snapring.
   f. Remove the spacer.
4. On models with ABS, remove the ABS speed sensor and wire harness clamp from the steering knuckle.
5. Remove the caliper and rotor.
6. Disconnect the lower ball joint.
7. Remove the steering knuckle with hub as follows:
   a. Remove the cotter pin and loosen the nut.
   b. Using a special tool 09950-40010 or equivalent, disconnect the steering knuckle.
   c. Remove the nut and knuckle.

To install:

8. Attach the steering knuckle and tighten the nut to 80 ft. lbs. (108 Nm). Install a new cotter pin.
9. Attach the lower ball joint, tighten the four mounting bolts to 59 ft. lbs. (80 Nm).
10. Attach the caliper and rotor.
11. Attach the ABS speed sensor and wire harness clamp if removed, tighten to 71 inch lbs. (8 Nm).
12. Attach the driveshaft.
13. Install the shock absorber.
14. Attach the wheel, lower the vehicle.
15. Tighten the lug nuts, the bleed the brake system.
16. Have the alignment checked at a reputable repair facility.

T100

1. Remove the front wheels.
2. Remove the caliper and front axle hub.
3. Measure the steering knuckle bushing thrust clearance as follows:
   a. Install a bolt in the drive shaft.
   b. Using a feeler gauge, measure the drive shaft thrust clearance between the steering knuckle outside bushing and spacer, by pulling the bolt and applying a load of 22 lb. (98 N).
   c. Standard clearance: 0.0039-0.0197 in. (0.10-0.50mm). Maximum 0.039 in. (1.0mm).
   d. If the thrust clearance is more than the maximum, replace the steering knuckle outside and inside bushings.
4. Detach the front shock from the lower control arm.
5. Separate the stabilizer bar from the lower control arm.
6. Remove the steering knuckle as follows:
   a. Using a pair of snapring pliers, remove the ring and spacer.
   b. Support the lower control arm with a jack.
   c. Remove the cotter pin and nut from the upper ball joint.
   d. Using a ball joint separator, detach the joint from the knuckle.
   e. Remove the bolts from the lower ball joint, then disconnect the knuckle from the joint.
   f. Push down the lower control arm, then remove the knuckle. Be careful not to damage the seal.

To install:

7. Install the knuckle as follows:
   a. Apply synthetic oil and lithium soap base chassis grease NLGI No. 1 or equivalent to the driveshaft.
   b. Push down on the lower control arm, then install the steering knuckle.
   c. Connect the lower ball joint to the steering knuckle, tighten the nut to 105 ft. lbs. (142 Nm).
   d. Install a new cotter pin.
   e. Install a spacer to the driveshaft.
   f. Using a pair of snapring pliers, install the ring.

➡If you replace the knuckle bushing, recheck the clearance of the driveshaft thrust.

   g. Using a feeler gage, measure the driveshaft thrust clearance between the knuckle and the outside bushing and spacer, by pulling the bolt and applying a load of 22 lbs. (98 N).
   h. Standard clearance should be 0.0039-0.0197 in. (0.10-0.50mm).
   i. If the clearance is not within specifications, replace the spacer.

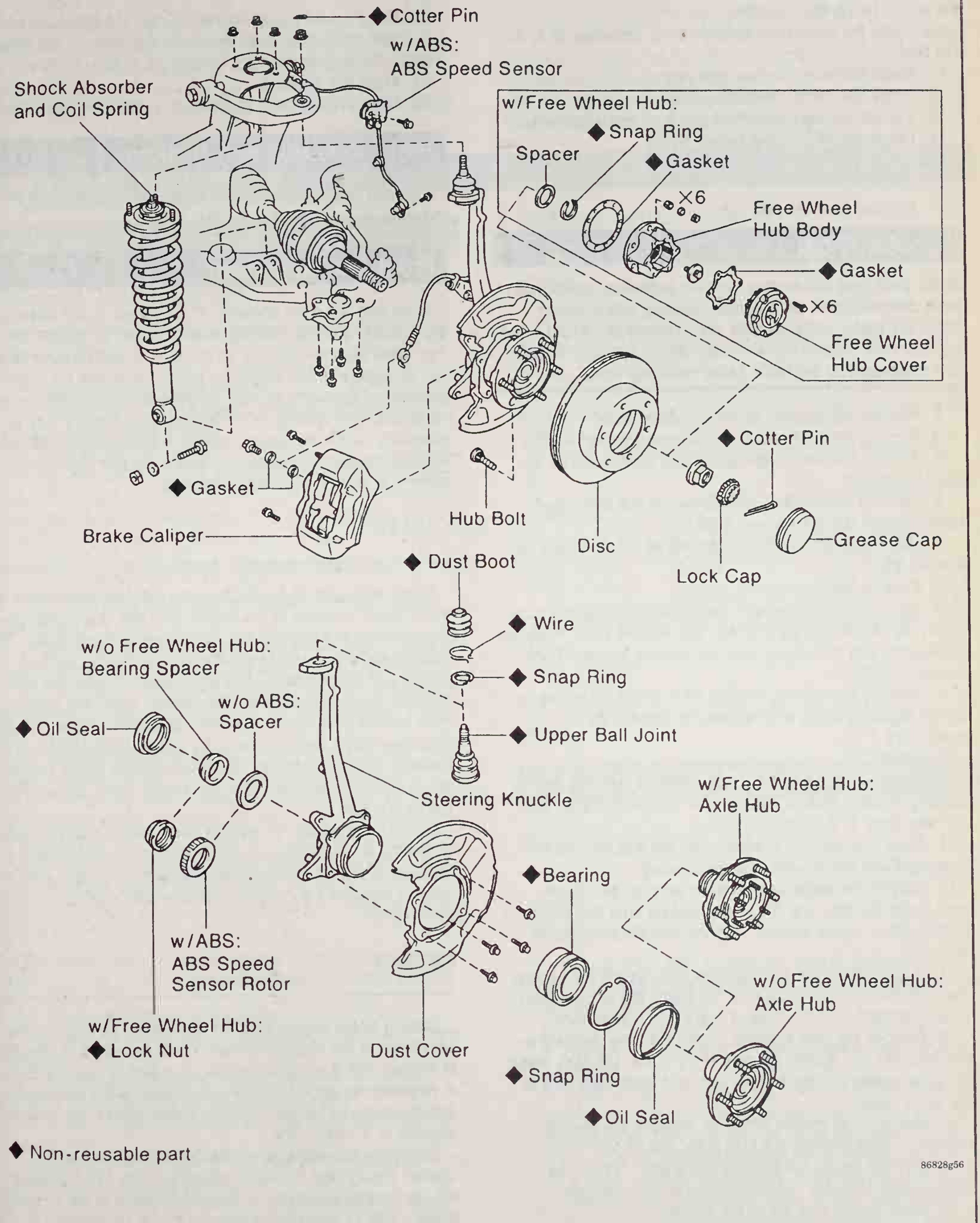

◆ Cotter Pin
w/ABS:
ABS Speed Sensor
Shock Absorber and Coil Spring
w/Free Wheel Hub:
◆ Snap Ring
Spacer
◆ Gasket
×6
Free Wheel Hub Body
◆ Gasket
×6
Free Wheel Hub Cover
◆ Cotter Pin
◆ Gasket
Brake Caliper
Hub Bolt
Disc
Grease Cap
Lock Cap
◆ Dust Boot
◆ Wire
◆ Snap Ring
◆ Upper Ball Joint
w/o Free Wheel Hub:
Bearing Spacer
w/o ABS:
Spacer
◆ Oil Seal
Steering Knuckle
w/Free Wheel Hub:
Axle Hub
◆ Bearing
w/ABS:
ABS Speed Sensor Rotor
w/o Free Wheel Hub:
Axle Hub
w/Free Wheel Hub:
◆ Lock Nut
Dust Cover
◆ Snap Ring
◆ Oil Seal
◆ Non-reusable part
86828g56

Fig. 51 Exploded view of the steering knuckle and hub — Tacoma shown

8. Connect the stabilizer bar to the lower control arm, tighten the nut to 19 ft. lbs. (25 Nm).
9. Attach the front shock to the lower control arm, tighten the nut to 101 ft. lbs. (137 Nm).
10. Install the dust cover and new seal, tighten to 13 ft. lbs. (18 Nm).
11. Install the front axle hub and caliper.
12. Install the wheel, lower the vehicle.
13. Tighten the lug nuts. Check the front end alignment.
14. Check the ABS speed sensor signal.

Land Cruiser

1. Remove the front axle hub.

⁂CAUTION

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

2. Remove the knuckle spindle mounting bolts.
3. Remove the dust seal and dust cover (splash shield).
4. Tap the knuckle spindle gently and remove it from the steering knuckle.
5. Turn the axle so that one flat part of the outer shaft faces upward; pull out the axle shaft.
6. Use a separator to disconnect the tie rod end from the knuckle arm.
7. Remove the oil seal and retainer.
8. Remove the knuckle arm bearing and bearing cap nuts. Lightly tap the slits of the washers and remove them. Push out the knuckle arm and shims from the steering knuckle. Don't lose the shims.
9. Remove the steering knuckle and bearing. Mark the removed adjusting shims and bearings by position for reassembly.

To install:

10. Install a new oil seal if it was removed from the axle housing. Install a new oil seal set (felt dust seal, rubber seal and steel ring, in that order).
11. Place the bearings in position on the knuckle and axle housing. Place the knuckle onto the housing.
12. Support the upper bearing inner race on the knuckle arm. Install the arm over the shims, making sure the shims are in their exact original location. Tap the knuckle arm into the inner race.
13. Support the lower bearing inner race. Install the bearing cap over the shims, making sure the shims are in their exact original location. Tap the bearing cap into the inner race.
14. Remove the race supports. Install the cone washers to the third arm and tighten the nuts to 71 ft. lbs. (96 Nm). Install the cone washers to the knuckle arm and tighten the nuts to the same value.
15. Use a spring tension gauge to measure the bearing preload. Correct preload is 6.6-13.2 lbs. (19-59 N).
16. Connect the tie rod to the knuckle arm. Tighten the castle nut to 67 ft. lbs. (91 Nm). Install a new cotter pin.
17. Install the oil seal set to the knuckle.
18. Install the axle shaft.
19. Pack the knuckle about 3/4 full with moly-disulfide grease.
20. Place a new gasket on the knuckle and install the spindle. Install the gasket, dust cover and dust seal on the spindle. Tighten the spindle mounting bolts to 34 ft. lbs. (47 Nm).
21. Install the axle hub.
22. Have the alignment checked at a reputable repair facility.

Front Axle Hub and Bearing

Hub and bearing removal and installation procedures for these models are given in Section 7.

Front End Alignment

If the tires are worn unevenly, if the vehicle is not stable on the highway or if the handling seems uneven in spirited driving, wheel alignment should be checked. If an alignment problem is suspected, first check tire inflation and look for other possible causes such as worn suspension and steering components, accident damage or unmatched tires. Repairs may be necessary before the wheels can be properly aligned. Wheel alignment requires sophisticated equipment and can only be performed at a properly equipped shop.

CASTER

Wheel alignment is defined by three different adjustments in three planes. Looking at the vehicle from the side, caster angle describes the steering axis rather than a wheel angle. The steering knuckle is attached to the strut at the top and the control arm at the bottom. The wheel pivots around the line between these points to steer the vehicle. When the upper point is tilted back, this is described as positive caster. Having a positive caster tends to make the wheels self-centering, increasing directional stability. Excessive positive caster makes the wheels hard to steer, while an uneven caster will cause a pull to one side.

Caster is adjustable on vehicles other than the Land Cruiser by turning the adjusting cams to reposition the arms. Land Cruisers do not allow adjustment; replacement of bent components is required if the caster measurement is out of specification.

CAMBER

Looking at the wheels from the front of the vehicle, camber adjustment is the tilt of the wheel. When the wheel is tilted in at the top, this is negative camber. In a turn, a slight amount of negative camber helps maximize contact of the outside tire with the road. Too much negative camber makes the vehicle unstable in a straight line.

Camber is adjustable on all vehicles except the Land Cruiser, through the turning of adjusting cams. Land Cruisers are not camber adjustable; if the measurement is out of specification, bent or damaged components must be replaced.

TOE-IN

Looking down at the wheels from above the vehicle, toe alignment is the distance between the front of the wheels relative to the distance between the back of the wheels. If the wheels are closer at the front, they are said to be toed-in or to have a negative toe. A small amount of negative toe enhances directional stability and provides a smoother ride on the highway. On most front wheel drive vehicles, standard toe adjustment is either zero or slightly positive. When power is applied to the front wheels, they tend to toe-in naturally.

Toe is adjustable on all models covered by this manual, and is generally measured in inches or degrees. It is adjusted by loosening the locknut on each tie rod end and turning the rod until the correct reading is achieved. The left and right rods must remain equal in length during all adjustments.

2WD REAR SUSPENSION

Leaf Springs

REMOVAL & INSTALLATION

See Figure 52

1. Loosen the rear wheel lug nuts.
2. Raise the rear of the vehicle. Support the frame and rear axle housing with stands.
3. Remove the lug nuts and the wheel.
4. Remove the cotter pin, nut, and washer from the lower end of the shock absorber.
5. Detach the shock absorber from the spring seat.
6. Remove the parking brake cable clamp.

➡Remove the parking brake equalizer, if necessary.

7. Unfasten the U-bolt nuts and remove the spring seat assemblies.
8. Adjust the height of the rear axle housing so that the weight of the rear axle is removed from the rear springs.
9. Unfasten the spring shackle retaining nuts. Withdraw the spring shackle inner plate. Carefully pry out the spring shackle with a bar.
10. Remove the spring bracket pin from the front end of the spring hanger and remove the rubber bushing.
11. Remove the spring. Use care not to damage the hydraulic brake line or the parking brake cable.

To install:

12. Install the rubber bushing in the eye of the spring.
13. Align the eye of the spring with the spring hanger bracket and drive the pin through the bracket holes and rubber bushings.

➡Use soapy water or glass cleaner as a lubricant, if necessary, to aid in pin installation. Never use oil or grease.

14. Finger-tighten the spring hanger nuts and/or bolts.
15. Install the rubber bushing in the spring eye at the opposite end of the spring.
16. Raise the free end of the spring. Install the spring shackle through the bushing and the bracket.
17. Install the shackle inner plate and finger-tighten the retaining nuts.
18. Center the bolt head in the hole which is provided in the spring seat on the axle housing.
19. Fit the U-bolts over the axle housing. Install the lower spring seat.
20. Tighten the U-bolt nuts to:
    - ½-ton Pick-Up — 108 ft. lbs. (147 Nm)
    - 1-ton Pick-Up and Cab & Chassis model — 90 ft. lbs. (123 Nm)
    - T100 — 97 ft. lbs. (132 Nm)
    - Tacoma — 90 ft. lbs. (120 Nm)
21. Install the parking brake cable and clamp. Install the equalizer, if it was removed.
22. Tighten the hanger pin and shackle nuts. Install the shock absorber bushings and washers. Tighten, and install the cotter pins.
23. Install the stabilizer link and hand tighten its retaining nuts.
24. Install the wheels, remove the stands, and lower the vehicle to the ground.
25. Bounce the truck several times to set the suspension and then tighten the shock absorber bolt. Tighten the hanger pin nut or bolt to:
    - ½-ton Pick-Up — 116 ft. lbs. (157 Nm)
    - 1-ton Pick-Up and Cab & Chassis model — 67 ft. lbs. (91 Nm)
    - Tacoma — 115 ft. lbs. (120 Nm)
    - T100 — 19 ft. lbs. (26 Nm)
26. Tighten the shackle pin to 67 ft. lbs. (91 Nm) for all vehicles.

Coil Springs and Shock Absorbers

REMOVAL & INSTALLATION

4Runner

See Figure 53

1. Elevate and safely support the vehicle on the frame rails. Place a floor jack under the rear axle housing and set the jack to hold the axle in place.
2. Remove the wheel(s).
3. Remove the parking brake cable bracket from the rear axle housing.
4. Remove the lower shock absorber mount bolt. If the shock is to be replaced, disconnect the upper mount and remove the shock. If the shock is not to be removed, the upper mount may be left connected during spring removal. If only the shock is to be replaced (removal of the spring not required, skip to Step 13 for reinstallation. Refer to Inspection and/or Disposal of Shock Absorbers in the Front Suspension part of this Section.

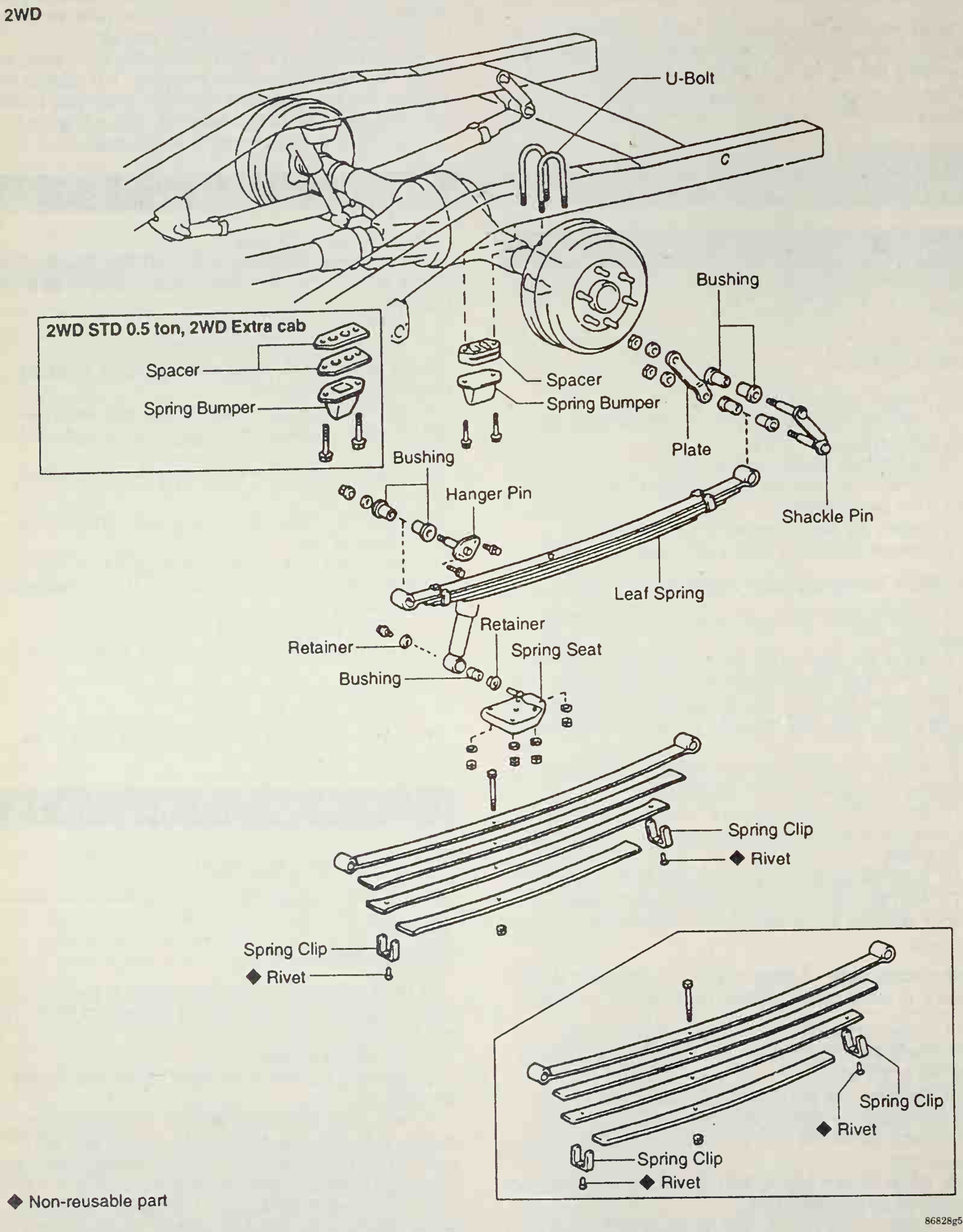

2WD
U-Bolt
C
2WD STD 0.5 ton, 2WD Extra cab
Spacer
Spring Bumper
Bushing
Spacer
Spring Bumper
Plate
Bushing
Hanger Pin
Shackle Pin
Leaf Spring
Retainer
Retainer
Spring Seat
Bushing
Spring Clip
◆ Rivet
Spring Clip
◆ Rivet
Spring Clip
◆ Rivet
Spring Clip
◆ Rivet
◆ Non-reusable part
86828g55

Fig. 52 Exploded view of the rear leaf spring and related components — 2WD Tacoma shown

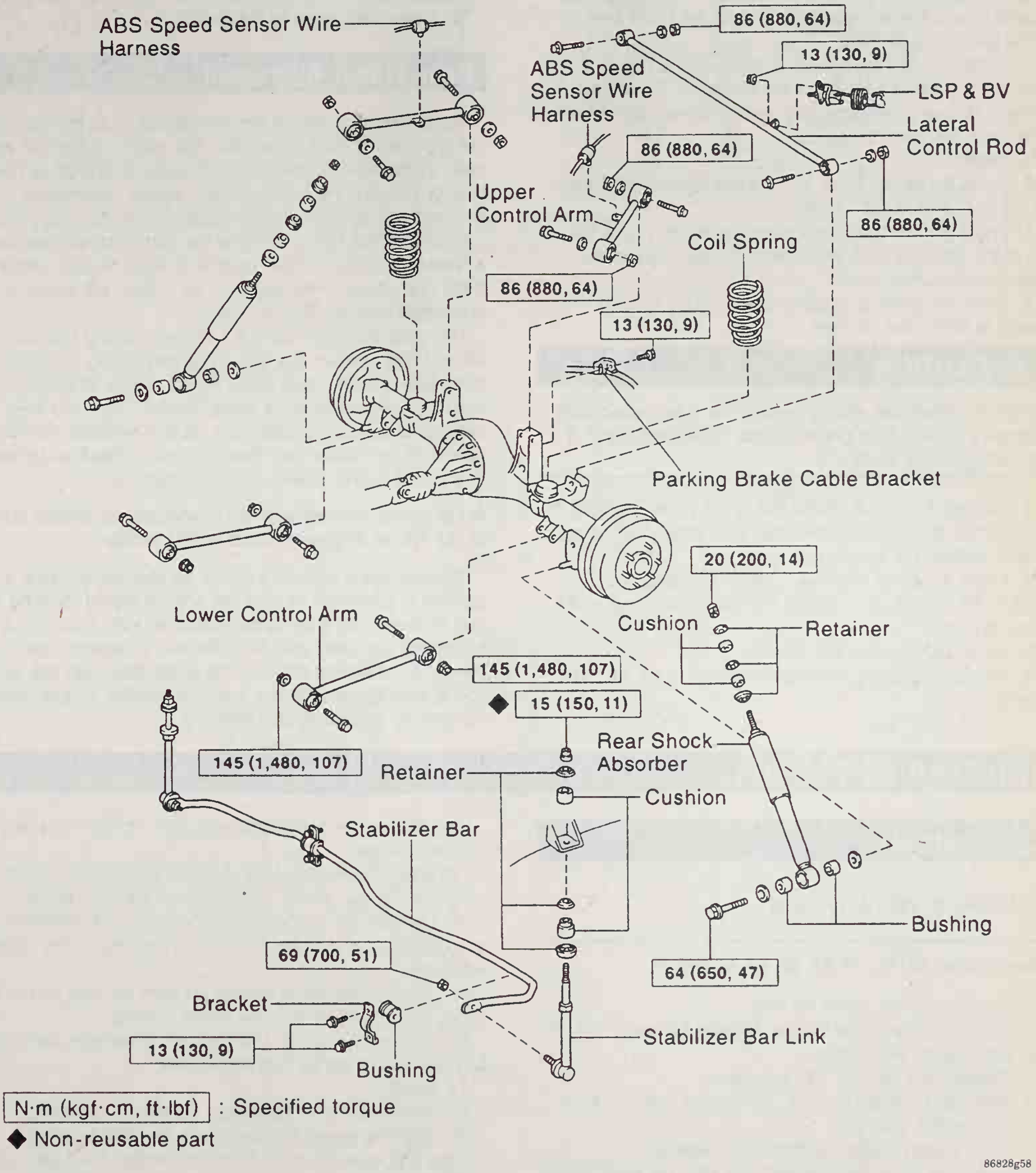

ABS Speed Sensor Wire Harness
86 (880, 64)
13 (130, 9)
ABS Speed Sensor Wire Harness
LSP & BV
Lateral Control Rod
86 (880, 64)
Upper Control Arm
86 (880, 64)
Coil Spring
86 (880, 64)
13 (130, 9)
Coil Spring
Parking Brake Cable Bracket
20 (200, 14)
Cushion
Retainer
Lower Control Arm
145 (1,480, 107)
◆ 15 (150, 11)
Rear Shock Absorber
145 (1,480, 107)
Retainer
Cushion
Stabilizer Bar
Bushing
69 (700, 51)
64 (650, 47)
Bracket
Stabilizer Bar Link
13 (130, 9)
Bushing
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g58

Fig. 53 Exploded view of the coil springs and other rear suspension components — 1996 4Runner shown

5. Disconnect the stabilizer bar brackets from the rear axle housing.

6. Disconnect the right shock absorber lower mount.

7. Remove the bolt(s) holding the lateral control arm to the frame.

8. Very carefully begin to lower the jack holding the axle housing. Use extreme caution not to snap the brake lines and/or parking brake cable.

9. While lowering the axle, remove the coil spring as it loses tension and remove the upper insulators. Once the spring is removed, the bump stop (spring follow) may be unbolted from the frame if desired.

To install:

10. Install the spring follow to the frame if removed, tightening the bolt to 11 ft. lbs. (15 Nm).

11. Install the coil spring and upper insulators. Check the end of the spring; it must be correctly installed against the stopper on the lower mount.

12. Once the spring is in place, jack the axle housing enough to hold it but no more.

⁂CAUTION

Do not compress the spring beyond the point reasonably necessary to hold it in place. Severe injury can occur if the spring comes loose.

13. Connect the lateral control rod to the frame, inserting the bolt from the front or shock absorber side. Install the nut but do NOT tighten it at this time.

14. Install the shock absorber. Tighten the upper mount to 14-18 ft. lbs. (20-25 Nm). Tighten the lower mount bolt to 47 ft. lbs. (64 Nm).

15. Attach the stabilizer bar brackets.

16. Attach the parking brake cable bracket to the rear axle housing.

17. Install the wheel(s) and lower the vehicle to the ground.

18. Bounce the rear of the vehicle several times to stabilize the suspension.

19. Use a floor jack to raise the rear axle housing (not the body of the vehicle) and support the axle with stands. Tighten the lateral control rod nut to 64-101 ft. lbs. (86-137 Nm).

20. Lower the vehicle to the ground.

Rear Wheel Alignment

The proper alignment of the rear wheels is as important as the alignment of the front wheels. The nature of the rear axles used on the vehicles covered in this book eliminates all possibility of adjusting the rear alignment; correct alignment is achieved only by the correct installation of component parts.

In spite of this fact, a check of the rear alignment can reveal a hidden cause of rear tire wear or a cause of poor handling. If the rear wheels are misaligned, the vehicle will exhibit unpredictable handling characteristics.

The usual symptoms include a different turning response into left and right corners and difficulty in maintaining a straight path. Both of these stem from the rear wheels attempting to steer the vehicle instead of rolling straight. This "rear steer' behavior is particularly hazardous on slick surfaces; the back wheels of the vehicle may attempt to go in directions unrelated to the front during braking or turning maneuvers.

➡For caster, camber and toe specifications, please refer to the Wheel Alignment chart in this section.

The rear wheel alignment should be checked any time a problem is suspected or after any serious impact involving the rear wheels. Even a low-speed encounter with a curb on a snowy day can bend an axle. If the rear alignment check reveals a component problem, the timely inspection has saved you at least the cost of new tires and possibly a more serious accident by eliminating poor handling.

4WD REAR SUSPENSION

Leaf Springs

REMOVAL & INSTALLATION

➧ See Figures 54, 55, 56, 57, 58, 59, 60 and 61

1. Loosen the rear wheel lug nuts.

2. Raise the rear of the vehicle. Support the frame and rear axle housing with stands.

3. Remove the lug nuts and the wheel.

4. Remove the cotter pin, nut, and washer from the lower end of the shock absorber.

5. On the Land Cruiser, perform the following:

    a. Remove the cotter pins and nuts from the lower end of the stabilizer link.

    b. Detach the link from the axle housing.

6. Detach the shock absorber from the spring seat.

7. Remove the parking brake cable clamp (except Land Cruiser).

➡Remove the parking brake equalizer, if necessary.

8. Unfasten the U-bolt and nuts, then remove the spring seat assemblies.

9. Adjust the height of the rear axle housing so that the weight of the rear axle is removed from the rear springs.

10. Unfasten the spring shackle retaining nuts. Withdraw the spring shackle inner plate. Carefully pry out the spring shackle with a bar.

11. Remove the spring bracket pin from the front end of the spring hanger and remove the rubber bushing.

12. Remove the spring. Use care not to damage the hydraulic brake line or the parking brake cable.

To install:

13. Install the rubber bushing in the eye of the spring.

14. Align the eye of the spring with the spring hanger bracket and drive the pin through the bracket holes and rubber bushings.

➡Use soapy water or glass cleaner as a lubricant, if necessary, to aid in pin installation. Never use oil or grease.

15. Finger-tighten the spring hanger nuts and/or bolts.

16. Install the rubber bushing in the spring eye at the opposite end of the spring.

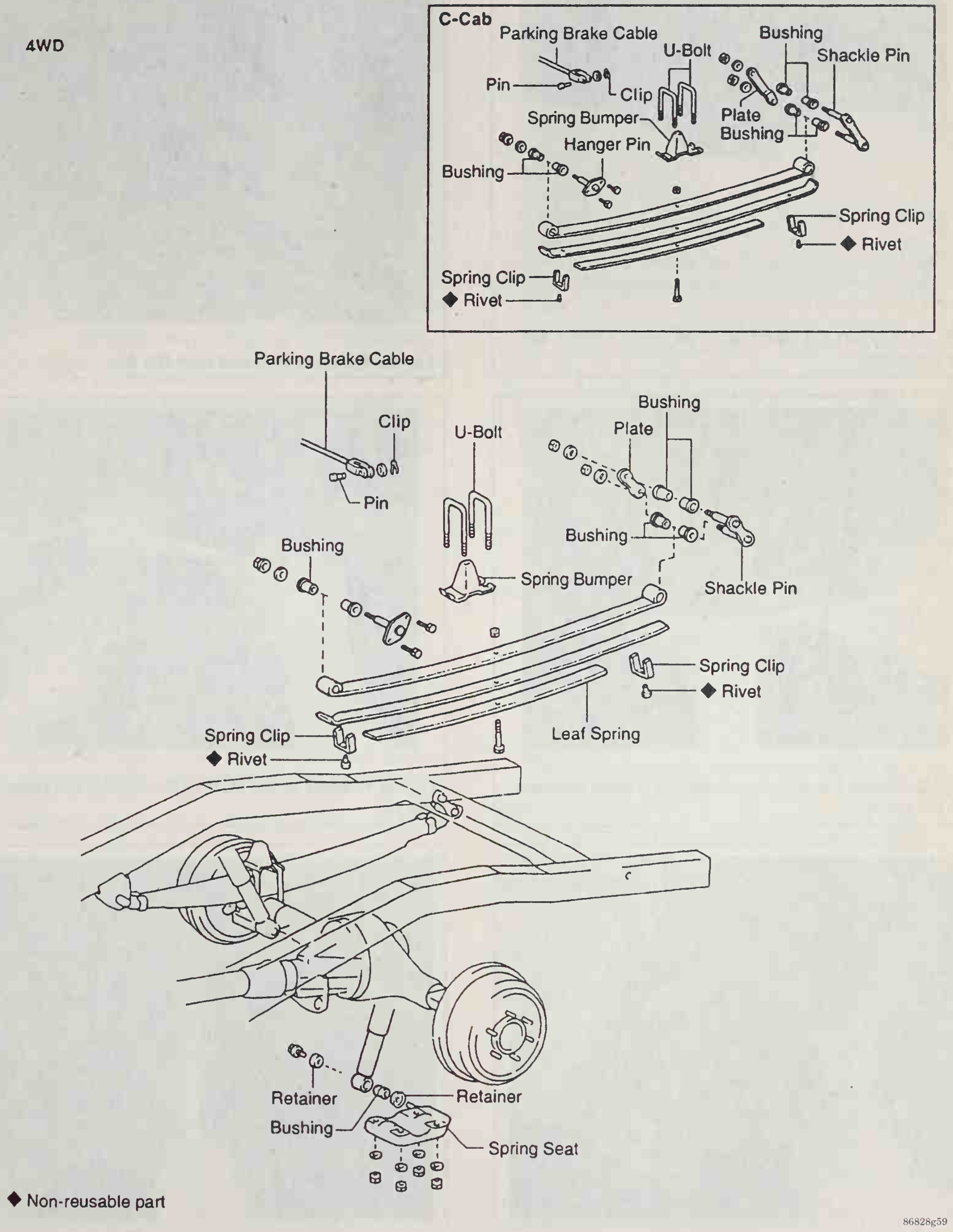

4WD
C-Cab
Parking Brake Cable
U-Bolt
Bushing
Shackle Pin
Pin
Clip
Spring Bumper
Plate
Bushing
Hanger Pin
Bushing
Spring Clip
◆ Rivet
Spring Clip
◆ Rivet
Parking Brake Cable
Clip
U-Bolt
Bushing
Plate
Pin
Bushing
Bushing
Spring Bumper
Shackle Pin
Spring Clip
◆ Rivet
Leaf Spring
Spring Clip
◆ Rivet
Retainer
Bushing
Retainer
Spring Seat
◆ Non-reusable part
86828g59

Fig. 54 Exploded view of the rear leaf spring and components — 4WD Tacoma shown

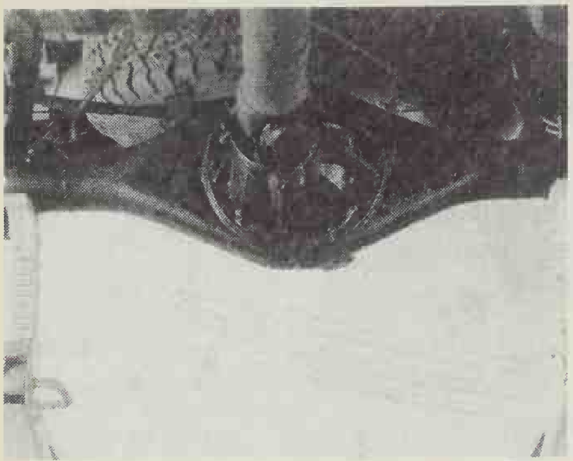


Fig. 55 Support the rear axle of the vehicle with a set of jackstands

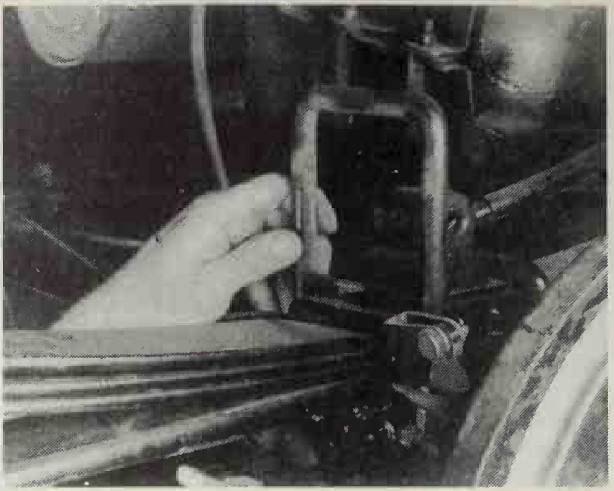


Fig. 58 Remove the U-bolt from the rear

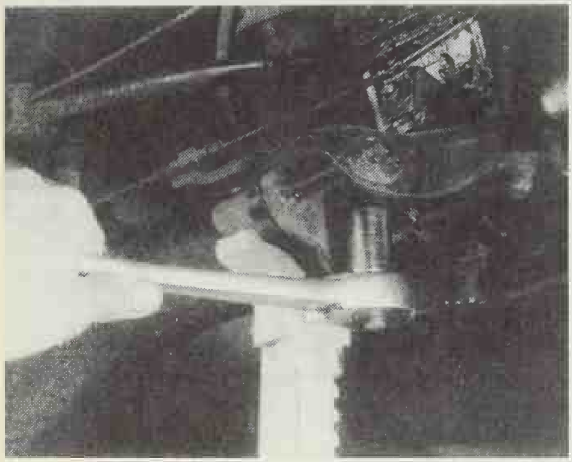


Fig. 56 Unbolt the rear axle mounting bracket attached to the spring

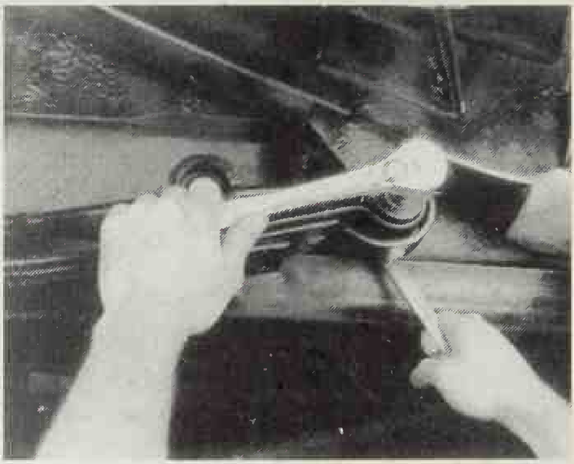


Fig. 59 Proceed to the front of the spring, and remove the pin

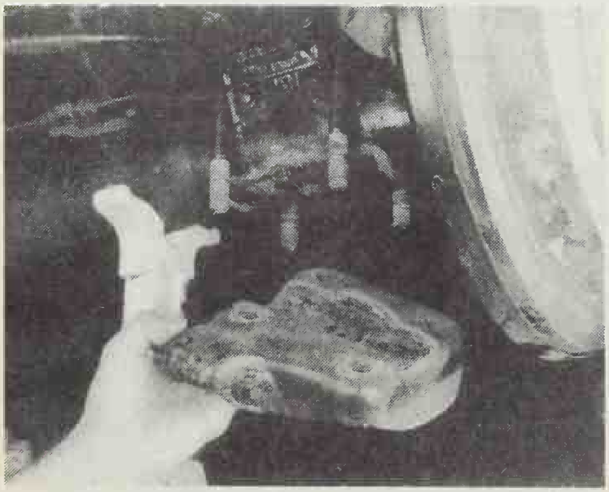


Fig. 57 Lower the seat assembly

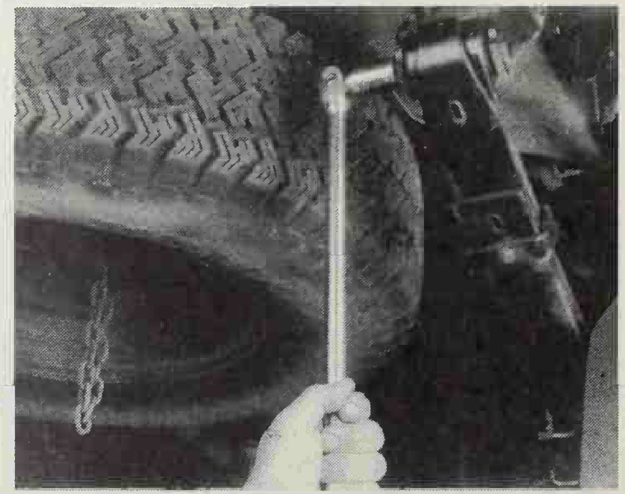


Fig. 60 Unbolt the rear mount then . . .

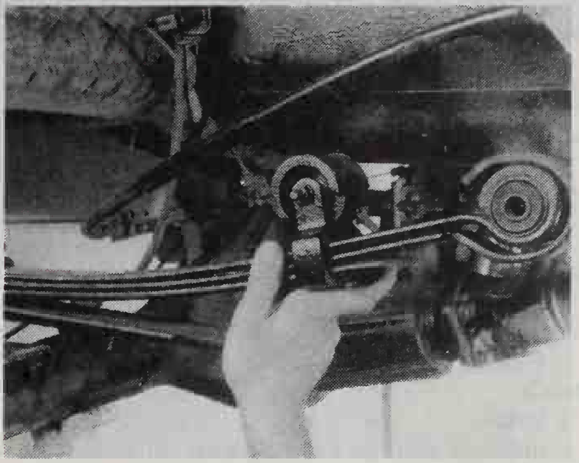

86828p56

Fig. 61 . . . carefully lower the spring from the vehicle. The jackstand must be removed by an assistant

17. Raise the free end of the spring. Install the spring shackle through the bushing and the bracket.
18. Install the shackle inner plate and finger-tighten the retaining nuts.
19. Center the bolt head in the hole which is provided in the spring seat on the axle housing.
20. Fit the U-bolts over the axle housing. Install the lower spring seat. Install the spring bumper on later 4WD models.
21. Tighten the U-bolt nuts to:
    - Xtra Cab — 90 ft. lbs. (123 Nm)
    - Pick-Up — 108 ft. lbs. (147 Nm)
    - Land Cruiser — 105 ft. lbs. (142 Nm)
    - T100 — 97 ft. lbs. (132 Nm)
    - Tacoma — 90 ft. lbs. (120 Nm)
22. Install the parking brake cable and clamp. Install the equalizer, if it was removed.
23. Tighten the hanger pin and shackle nuts. Install the shock absorber bushings and washers. Tighten, and install the cotter pins.
24. Install the stabilizer link and hand-tighten its retaining nuts.
25. Install the wheels, remove the stands, and lower the vehicle to the ground.
26. Bounce the truck several times to set the suspension and then tighten the shock absorber bolt. Tighten the hanger pin nut or bolt to:
    - Land Cruiser — 90 ft. lbs. (122 Nm)
    - ½-ton Pick-Up — 116 ft. lbs. (157 Nm)
    - 1-ton Pick-Up and Cab & Chassis model — 67 ft. lbs. (91 Nm)
    - Tacoma — 115 ft. lbs. (120 Nm)
    - T100 — 19 ft. lbs. (26 Nm)
27. Tighten the shackle pin to 67 ft. lbs. (91 Nm) for all vehicles.

Coil Springs and Shock Absorbers

REMOVAL & INSTALLATION

4Runner

1. Elevate and safely support the vehicle on the frame rails. Place a floor jack under the rear axle housing and set the jack to hold the axle in place.
2. Remove the wheel(s).
3. Remove the parking brake cable bracket from the rear axle housing.
4. Remove the lower shock absorber mount bolt. If the shock is to be replaced, disconnect the upper mount and remove the shock. If the shock is not to be removed, the upper mount may be left connected during spring removal. If only the shock is to be replaced (removal of the spring not required, skip to Step 13 for reinstallation. Refer to Inspection and/or Disposal of Shock Absorbers in the Front Suspension part of this Section.
5. Disconnect the stabilizer bar brackets from the rear axle housing.
6. Disconnect the right shock absorber lower mount.
7. Remove the bolt(s) holding the lateral control arm to the frame.
8. Very carefully begin to lower the jack holding the axle housing. Use extreme caution not to snap the brake lines and/or parking brake cable.
9. While lowering the axle, remove the coil spring as it loses tension and remove the upper insulators. Once the spring is removed, the bump stop (spring follow) may be unbolted from the frame if desired.

To install:

10. Install the spring follow to the frame if removed, tightening the bolt to 11 ft. lbs. (15 Nm).
11. Install the coil spring and upper insulators. Check the end of the spring; it must be correctly installed against the stopper on the lower mount.
12. Once the spring is in place, jack the axle housing enough to hold it but no more.

⁂CAUTION

Do not compress the spring beyond the point reasonably necessary to hold it in place. Severe injury can occur if the spring comes loose.

13. Connect the lateral control rod to the frame, inserting the bolt from the front or shock absorber side. Install the nut but do NOT tighten it at this time.
14. Install the shock absorber. Tighten the upper mount to 14-18 ft. lbs. (20-25 Nm). Tighten the lower mount bolt to 47 ft. lbs. (64 Nm).
15. Attach the stabilizer bar brackets.
16. Attach the parking brake cable bracket to the rear axle housing.
17. Install the wheel(s) and lower the vehicle to the ground.
18. Bounce the rear of the vehicle several times to stabilize the suspension.

19. Use a floor jack to raise the rear axle housing (not the body of the vehicle) and support the axle with stands. Tighten the lateral control rod nut to 64-101 ft. lbs. (86-137 Nm).
20. Lower the vehicle to the ground.

Land Cruiser

➧ See Figure 62

1. Elevate and safely support the vehicle on the frame rails. Place a floor jack under the rear axle housing and set the jack to hold the axle in place.
2. Remove the wheel(s).
3. Remove the lower shock absorber mount bolt. If the shock is to be replaced, disconnect the upper mount and remove the shock. If the shock is not to be removed, the upper mount may be left connected during spring removal. If only the shock is to be replaced (removal of the spring not required, skip to Step 13 for reinstallation. Refer to Inspection and/or Disposal of Shock Absorbers in the Front Suspension part of this Section.
4. Disconnect the stabilizer bar brackets from the rear axle housing.
5. Remove the bolt(s) holding the lateral control arm to the rear axle housing.
6. Very carefully begin to lower the jack holding the axle housing. Use extreme caution not to snap the brake lines and/or parking brake cable.
7. While lowering the axle, remove the coil spring as it loses tension and remove the upper insulators. Once the spring is removed, the bump stop (spring follow) may be unbolted from the frame if desired.

To install:

8. Install the spring follow to the frame if removed, tightening the bolt to 11-21 ft. lbs. (15-28 Nm).
9. Install the coil spring and upper insulators. Check the end of the spring; it must be correctly installed against the stopper on the lower mount.
10. Once the spring is in place, jack the axle housing enough to hold it but no more.

✲✲CAUTION

Do not compress the spring beyond the point reasonably necessary to hold it in place. Severe injury can occur if the spring comes loose.

11. Connect the lateral control rod to the axle housing, inserting the bolt from the front or shock absorber side. Install the nut but do NOT tighten it at this time.
12. Install the shock absorber. Tighten the upper mount to 37 ft. lbs. (50 Nm). Tighten the lower mount bolt to 47-51 ft. lbs. (64-69 Nm).
13. Install the stabilizer bar to the axle housing.
14. Install the wheel(s) and lower the vehicle to the ground.
15. Bounce the rear of the vehicle several times to stabilize the suspension.
16. Use a floor jack to raise the rear axle housing, then support the axle with stands. Tighten the lateral control rod nut to 130 ft. lbs. (177 Nm).
17. Lower the vehicle to the ground.

Stabilizer Bar

REMOVAL & INSTALLATION

1. Jack up and support the vehicle.
2. Disconnect the stabilizer bar links as follows:
   a. Remove the nuts and disconnect the stabilizer bar links from the stabilizer bar.
   b. Hold the link with a wrench, then remove the nut, retainers, cushions and link.
3. Remove the bolts and stabilizer bar with cushions and brackets.

To install:

4. Install the bushings to the stabilizer bar so the cutout of the bushing faces the under side of the vehicle.
5. Install the bar to the rear axle housing, with bushings and brackets. Tighten the bolts to 9 ft. lbs. (13 Nm) on the 4Runner, or 13 ft. lbs. (18 Nm) on the Land Cruiser.
6. Attach the retainers and cushions to the bar links. Hold the stabilizer bar link with a wrench, then install a new nut. Tighten the nut to 14-19 ft. lbs. (19-25 Nm) on the 4Runner, or 76 ft. lbs. (103 Nm) on the Land Cruiser.
7. Install the nuts to the stabilizer bar, tighten to 51 ft. lbs. (69 Nm) on the 4Runner, or 19 ft. lbs. (25 Nm) on the Land Cruiser.
8. Install the front wheels.
9. Have the alignment checked at a reputable repair facility.

Lateral Control Rod

REMOVAL & INSTALLATION

Land Cruiser

1. Raise and support the rear of the vehicle.
2. Remove the rear wheel.
3. Remove the bolt, nut and plate washer, then disconnect the lateral control rod.
4. Remove the bolt and lateral control rod from the axle housing.

To install:

5. Attach the bolt that connects the rod to the axle housing, tighten to 181 ft. lbs. (245 Nm).
6. Attach the bolt with washer and tighten the nut to the rod to 130 ft. lbs. (177 Nm).
7. Install the wheel.
8. Lower the vehicle, then tighten the lug nuts.
9. Have the alignment checked at a reputable repair facility.

4Runner

1. Raise and support the rear of the vehicle.
2. Disconnect the right side shock absorber.
3. Remove the bolt, then disconnect the harness for the Load Sensing Proportioning and Bypass Valve (LSPBV).
4. Remove the bolt, nut and plate washer, then disconnect the lateral control rod from the frame.
5. Remove the bolt and lateral control rod from the axle housing side.

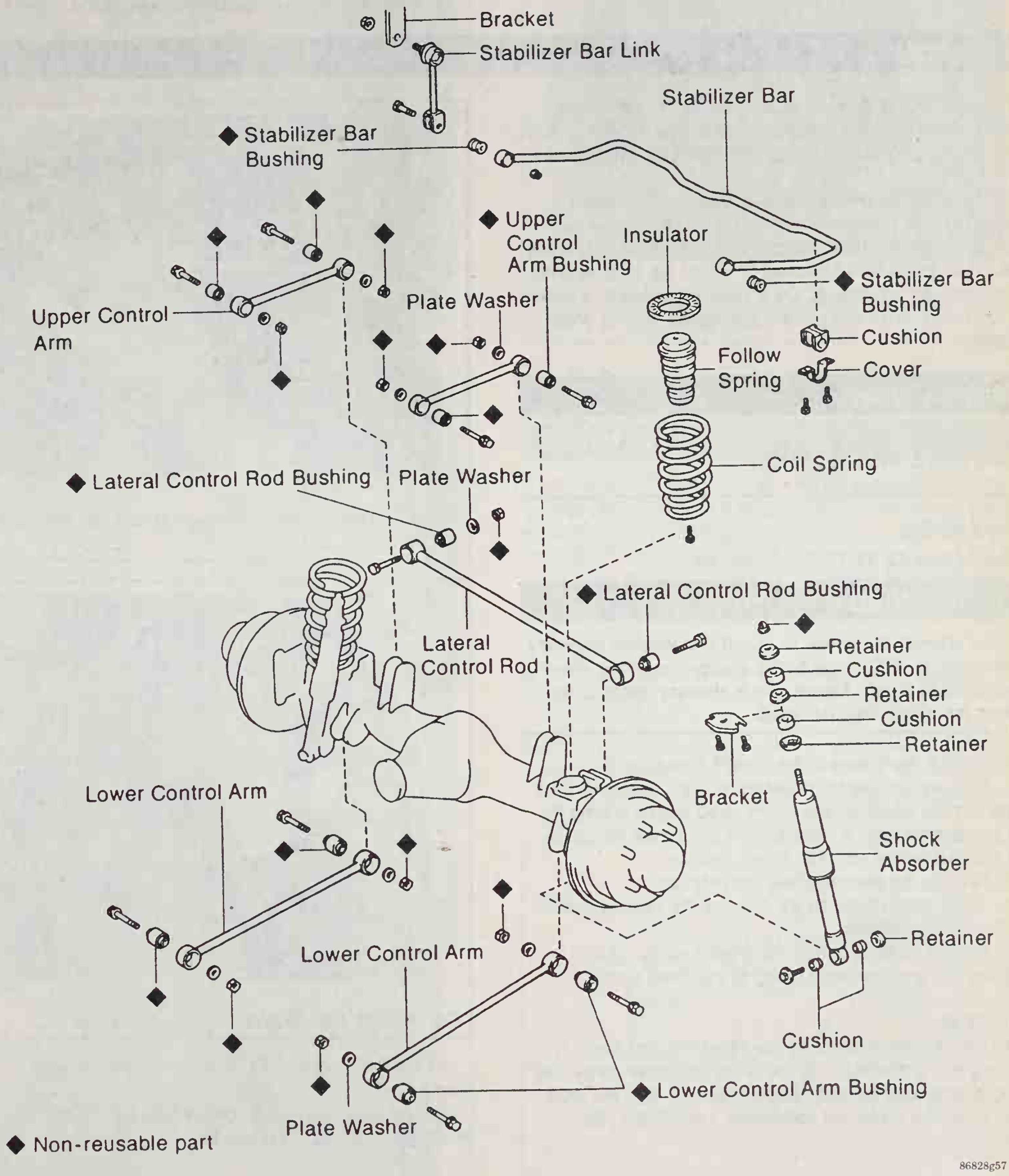

Bracket
Stabilizer Bar Link
Stabilizer Bar
◆ Stabilizer Bar Bushing
◆ Upper Control Arm Bushing
Insulator
Upper Control Arm
Plate Washer
◆ Stabilizer Bar Bushing
Cushion
Cover
Follow Spring
Coil Spring
◆ Lateral Control Rod Bushing
Plate Washer
◆ Lateral Control Rod Bushing
Lateral Control Rod
Retainer
Cushion
Retainer
Cushion
Retainer
Bracket
Shock Absorber
Lower Control Arm
Lower Control Arm
Retainer
Cushion
◆ Lower Control Arm Bushing
Plate Washer
◆ Non-reusable part
86828g57

Fig. 62 Exploded view of the coil springs and other rear suspension components — Land Cruiser shown

To install:

6. Attach the bolt that connects the rod to the axle housing, tighten to 64 ft. lbs. (86 Nm).
7. Attach the bolt with washers, then tighten the rod to the frame side to 64 ft. lbs. (86 Nm).
8. Attach the bolt, then connect the harness for the Load Sensing Proportioning and Bypass Valve (LSPBV). Tighten the bolt to 9 ft. lbs. (13 Nm).
9. Attach the right side shock absorber.
10. Lower the vehicle.
11. Have the alignment checked at a reputable repair facility.

STEERING

Toyota offers two types of power steering on their trucks. There is standard and Progressive Power Steering (PPS). Both types have a recirculating ball system and rotary type hydraulic control valve.

On the PPS, the vehicle speed is detected by a speed sensor and fluid pressure acting on the piston is varied accordingly. When the truck is stopped or when moving at a low speed, fluid pressure is increased to lighten the force required for steering. At high speeds, the pressure is reduced to lessen the amount of assist and provide appropriate steering wheel response.

Steering Wheel

REMOVAL & INSTALLATION

Without Air Bag

➧ See Figures 63, 64, 65, 66, 67 and 68

⁂WARNING

Do not attempt to remove or install the steering wheel by hammering on it. Damage to the energy absorbing steering column could result. Always use a steering wheel puller to extract the wheel from the shaft.

1. Position the wheels in the straight ahead position.
2. Remove the steering wheel center pad. Check the back of the steering wheel spokes for recessed screws holding the pad and remove them if present. If no screws are found, the pad should snap out with firm finger pressure.
3. Remove the steering wheel retaining nut.
4. Scribe matchmarks on the hub and the steering shaft to aid in proper installation.
5. Use the puller to extract the wheel from the shaft. Unplug any wiring connectors running to the wheel once it is loose.

To install:

6. Align the matchmarks on the wheel hub and shaft. Attach any wiring connectors to the wheel and make certain the wiring is positioned correctly. Install the wheel onto the shaft.
7. Install the center nut and tighten it to 25-35 ft. lbs. (34-47 Nm).

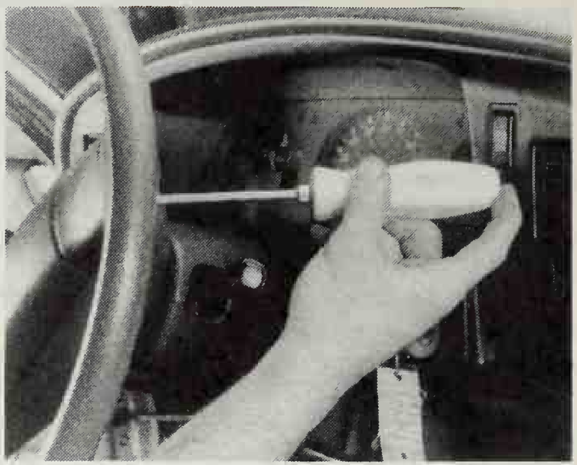

86828p25

Fig. 63 Using a suitable prytool, loosen the mounting for the center pad

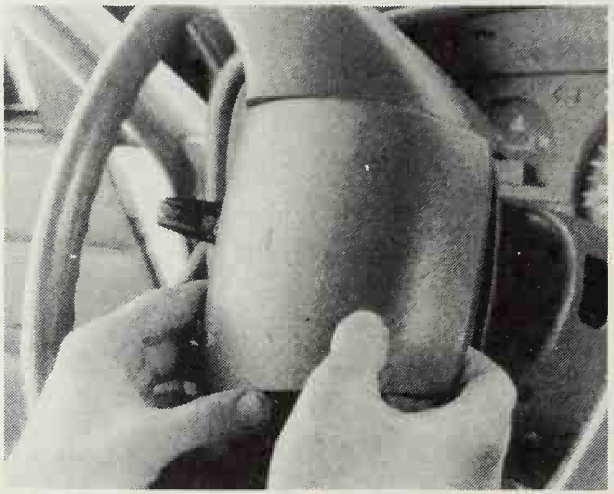

86828p26

Fig. 64 With your fingers, pry up on the pad . . .

8. Install the center pad, making sure it is correctly secured.
9. Test drive the vehicle, checking for correct steering wheel alignment and horn function.

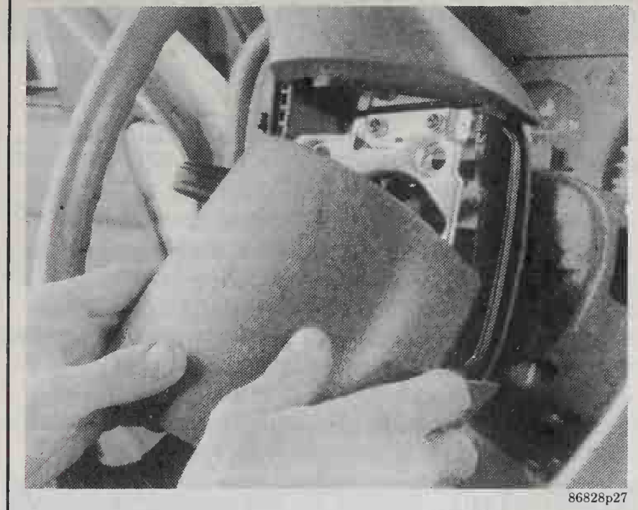


Fig. 65 . . . to release it from the steering wheel

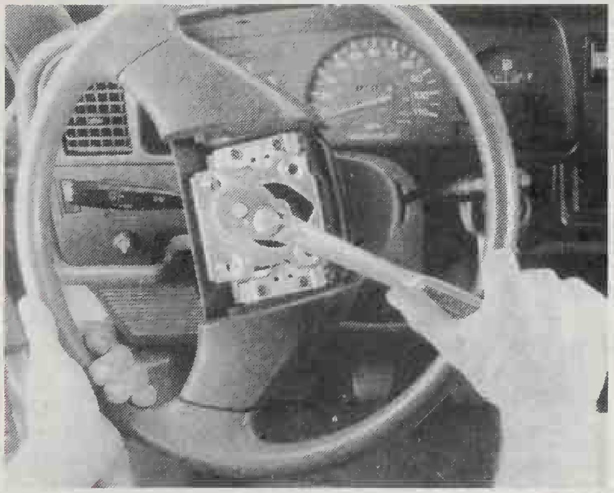


Fig. 66 Place a socket on the center nut and loosen

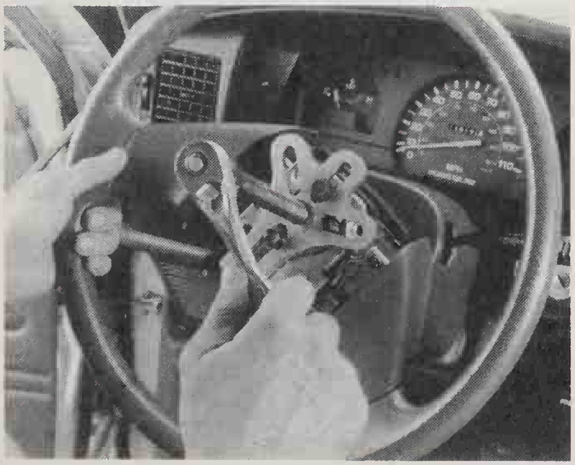


Fig. 67 Use the puller to extract the wheel from the shaft

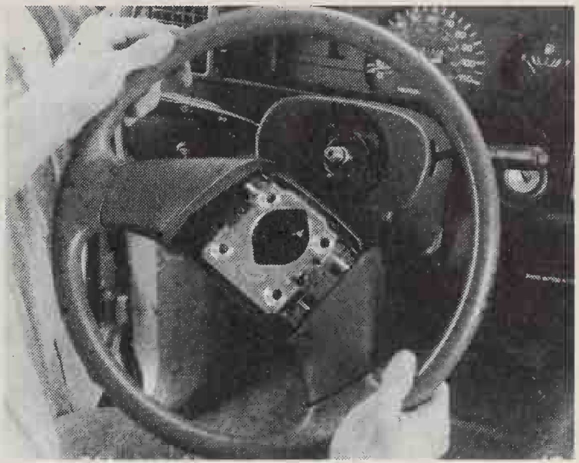


Fig. 68 Lift the wheel off the column, and separate any wires that may be attached

With Air Bag

- See Figures 69, 70 and 71

⁂CAUTION

Work must not begin until at least 90 seconds after the ignition switch is turned to the LOCK position and the negative battery cable is disconnected from the battery. The SRS is equipped with a back-up power source so that if the work is started within the 90 seconds of disconnecting the negative terminal, the SRS may be deployed.

1. Disarm the SRS system.
2. On models without tilt steering, proceed as follows:
   a. Place the front wheels facing straight ahead.
   b. Remove the 2 steering wheel lower covers. Using a Torx® driver, loosen the Torx® screws until the groove along the screw circumference catches on the screw case.
   c. Pull out the wheel pad from the steering wheel, then detach the air bag connector.

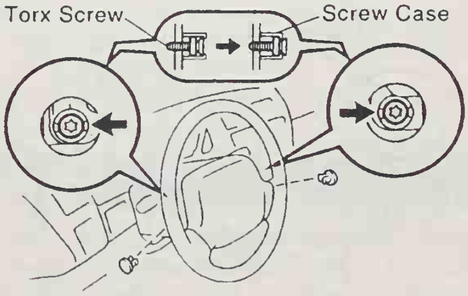


Fig. 69 Using a Torx® driver, loosen the Torx® screws until the groove along the screw circumference catches on the screw case

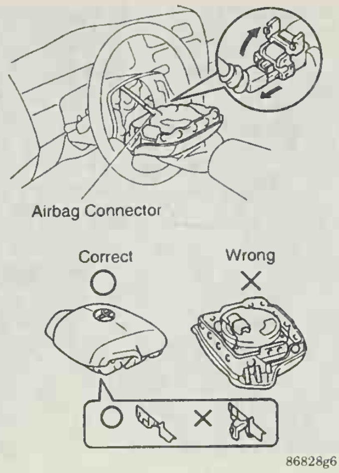


Fig. 70 When storing the wheel pad with an air bag, keep the upper surface of the pad facing upwards

3. Remove the steering wheel set nut. A special wheel puller may be needed. Place matchmarks on the steering wheel and mainshaft assembly. Remove the wheel.
4. Unplug the harness.

To install:

5. Align the matchmarks on the wheel and the mainshaft. Tighten the wheel set nut to 25 ft. lbs. (34 Nm).
6. Attach the harness.
7. Attach the air bag harness, then install the wheel pad after confirming that the circumference groove of the Torx® screw is caught on the screw case.
8. Using a Torx® driver, tighten the screws to 78 inch lbs. (9 Nm).
9. Install the steering wheel covers.
10. Check the steering wheel center point.

Combination Switch

Removal and installation of the combination switch is covered in Section 6.

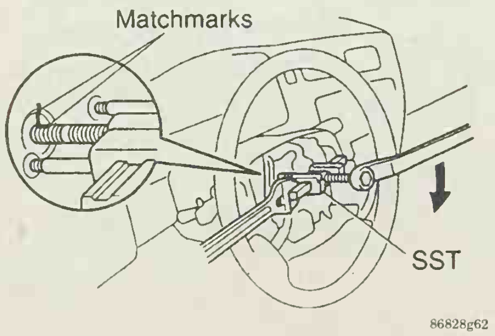


Fig. 71 A special wheel puller may be needed. Place matchmarks on the steering wheel and mainshaft assembly

Ignition Switch

REMOVAL & INSTALLATION

See Figures 72 and 73

Both the electrical portion of the ignition switch and the key/lock portion may be replaced without removing the housing or bracket holding them. The bracket holding the ignition switch assembly is held to the column by bolts whose heads were intentionally broken off at installation. About the only time the bracket must be removed would be if the steering column or tube must be replaced. In the event that the bracket must be removed, the headless bolts must be center-punched, drilled and removed with a screw extracting tool.

CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative battery cable is disconnected from the battery. The SRS is equipped with a back-up power source so that if the work is started within the 90 seconds of disconnecting the negative terminal, the SRS may be deployed.

1. Disarm the SRS system.
2. Turn the ignition **OFF** and remove the key from the ignition.
3. Remove the steering wheel pad and remove the steering wheel.
4. Remove the upper and lower steering column covers. Remove the combination switch.
5. Unplug the ignition wiring harness connector.
6. If only the electrical switch needs replacement, remove the retaining screw at the back of the lock housing and remove the switch. If the automatic transmission interlock relay must be changed, it may be unbolted from the housing; don't lose the spring and lock pin.
7. If the key lock assembly is to be changed, place the key in the switch and turn the key to the **ACC** position. Insert a

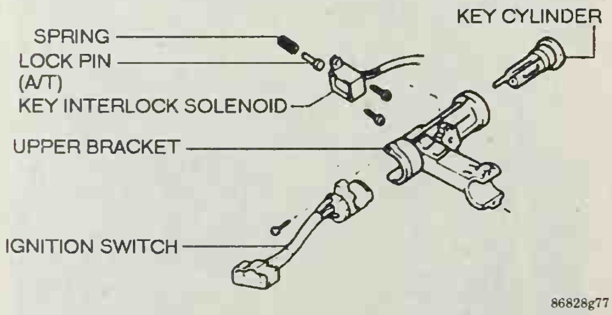


Fig. 72 Exploded view of the ignition switch assembly

thin rod in the hole at the bottom of the housing and press the stop tab inward. While holding the tab in, pull the cylinder out of the housing.

To install:

8. Install the new lock cylinder if necessary, making certain the key is in the **ACC** position before installation. Insert the cylinder and be sure the stop tab engages the hole. Once installed, turn the switch **OFF** and remove the key.
9. Align the electrical switch with the back of the key cylinder. Install the retaining screw.
10. Attach the wiring harness connector. Make certain the harness is correctly routed and held by its clamps and clips.
11. Install the combination switch.
12. Install the steering wheel. Install the upper and lower steering column covers.
13. Operate the ignition switch in all positions, checking for correct function and lack of binding.

Steering Column

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

▶ See Figures 74 and 75

1. Disconnect the negative battery cable.
2. Remove the steering wheel. Matchmark the wheel and mainshaft.
3. Remove the lower left side dash trim panel. Remove the heater duct (No. 1) from below the dash.
4. Remove the upper and lower steering column covers.
5. Unplug the wiring connectors for the combination switch and the ignition switch.
6. Remove the combination switch.
7. Below the vehicle, at the steering gearbox, make matchmarks on the steering mainshaft and the worm shaft entering the gearbox. Loosen or remove the pinchbolt holding the mainshaft to the worm shaft.
8. Inside the vehicle, remove the bolts holding the rubber steering hole cover to the floorboard.
9. Remove one of the two bolts holding the steering column to the instrument panel subframe. Remove the nut(s) holding the column.
10. Have an assistant support the steering column inside the vehicle before removing the other mounting bolt. The column is heavy and will come down heavily on you if not supported.
11. Pull the assembly into the vehicle, disconnecting the mainshaft from the steering gearbox. Remove the steering column from the vehicle.

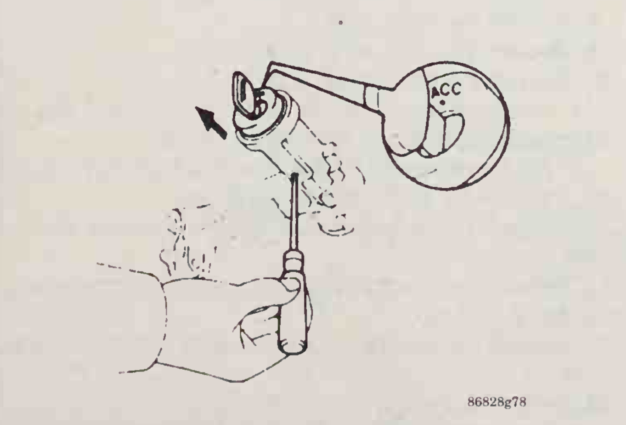


Fig. 73 Insert a thin rod in the hole at the bottom of the housing and press the stop tab inward. While holding the tab in, pull the cylinder out of the housing

To install:

12. Place the column assembly into the vehicle and fit the mainshaft through the floor hole.
13. Under the vehicle, align the matchmarks and fit the shaft onto the worm gear. Make certain the marks align exactly. For Pick-Ups and 4Runner, install the pinch bolt and tighten it to 26 ft. lbs. (35 Nm).
14. In the cab, lift the column into position and install the retaining bolts, tightening them to 19 ft. lbs. (25 Nm).
15. Reposition the floor hole cover and install the bolts.
16. Install the combination switch.
17. Attach the wiring harnesses for the ignition and combination switches.
18. Install the upper and lower steering column covers.
19. Install the heater duct; install the lower left dash trim panel.
20. Install the steering wheel and center pad.
21. Connect the negative battery cable.

1996 MODELS

▶ See Figure 76

1. Disconnect the negative battery cable.

✳✳CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Remove the steering wheel pad.
    a. Place the front wheels straight ahead.
    b. Remove the two steering wheel lower No. 2 covers.
    c. Using a Torx® driver, loosen the Torx® screws. Loosen them until the groove along the screw circumference catches on the screw case.
    d. Pull out the wheel pad from the steering wheel and disconnect the air bag connector.

✳✳CAUTION

The air bag system (SRS) must be disarmed before removing the steering wheel. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Matchmark the steering wheel to the mainshaft. Using a steering wheel puller, remove the steering wheel.
4. Remove the upper and lower column covers.
5. Remove the instrument lower finish panel. Disconnect the hood lock control cable and fuel lid control cable.
6. Remove the No. 2 heater register duct.

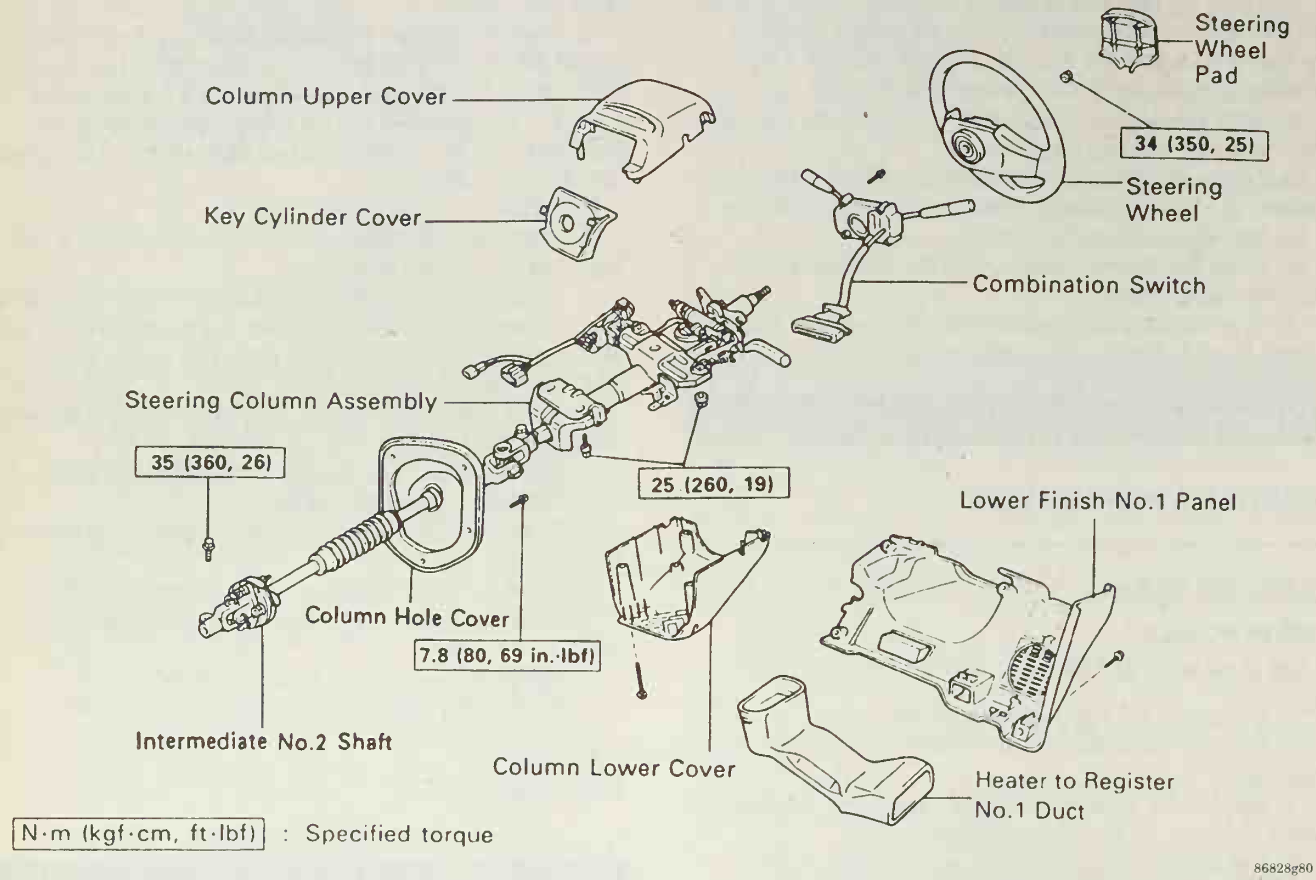

Steering Wheel Pad
Column Upper Cover
34 (350, 25)
Steering Wheel
Key Cylinder Cover
Combination Switch
Steering Column Assembly
35 (360, 26)
25 (260, 19)
Lower Finish No.1 Panel
Column Hole Cover
7.8 (80, 69 in.·lbf)
Intermediate No.2 Shaft
Column Lower Cover
Heater to Register No.1 Duct
N·m (kgf·cm, ft·lbf) : Specified torque
86828g80

Fig. 74 Exploded view of the steering column — 1989-95 Pick-Up and 4Runner

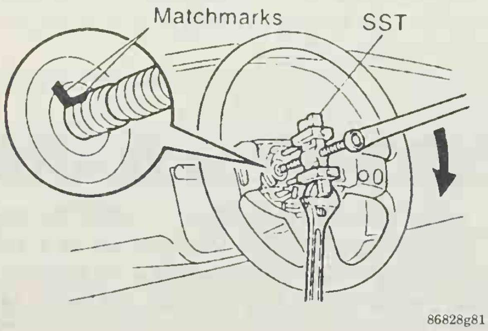

Matchmarks
SST
86828g81

Fig. 75 Before removing a steering wheel, always matchmark the wheel and mainshaft

7. Remove the combination switch with the spiral cable.
   a. Unplug the two connectors and the air bag wiring.
8. Remove the spiral cable.
9. Remove the brake pedal return spring.
10. Remove the intermediate shaft No. 2.
    a. Place matchmarks on the universal joint No. 2 and the intermediate shaft No. 2. Remove the A bolt.
    b. Place matchmarks on the intermediate shaft No. 2 and the control valve shaft. Remove the B bolt.
    c. Slide the intermediate shaft No. 2 and remove the shaft.
11. Remove the column hole cover and the column hose cover No. 2 set bolt.
12. Remove the steering column assembly with the universal joint No. 2.
13. Disconnect the universal joint No. 2.
    a. Place matchmarks on the steering column assembly and the universal joint No. 2.
    b. Remove the bolt. Remove the column hole cover and the column hose cover No. 2.

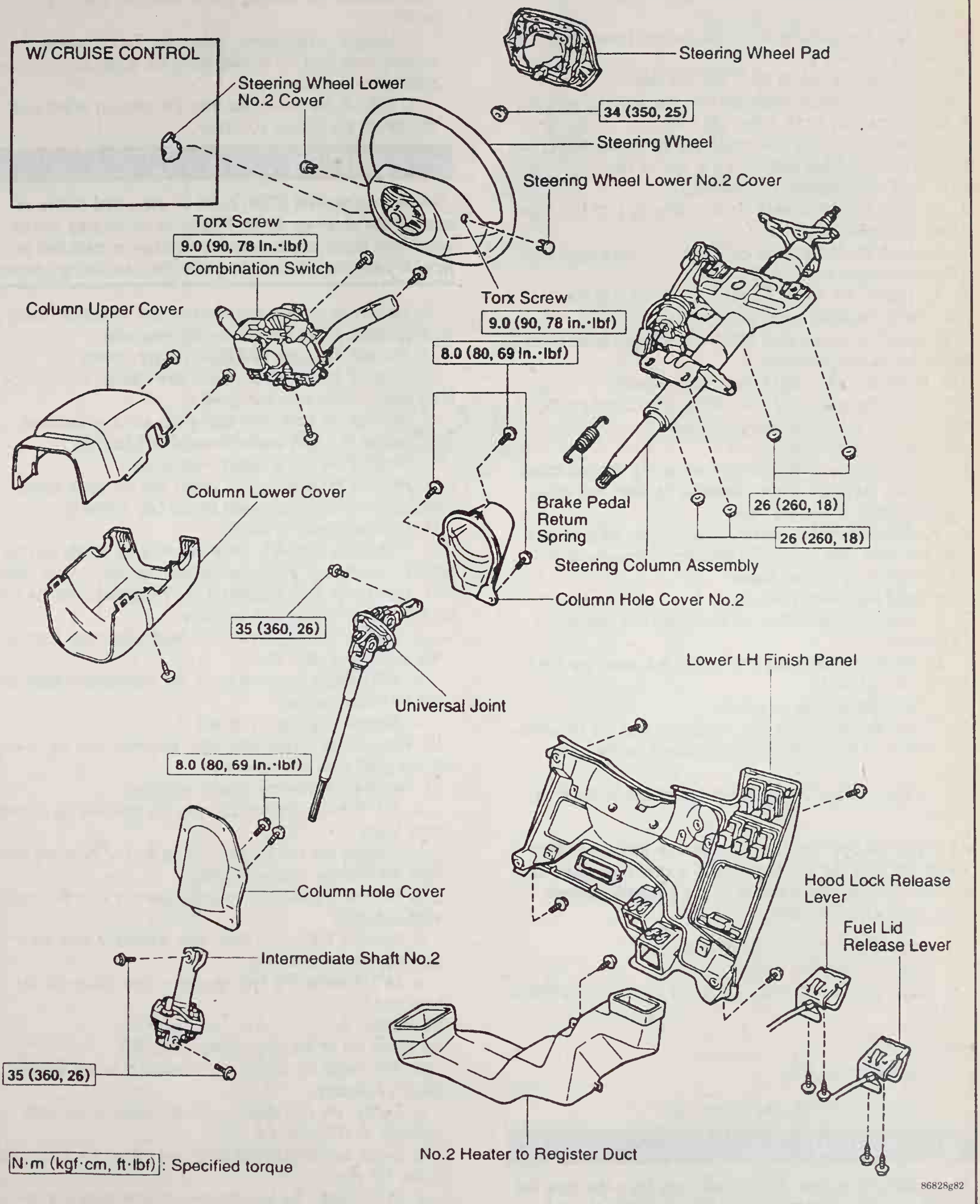

W/ CRUISE CONTROL
Steering Wheel Lower No.2 Cover
Steering Wheel Pad
34 (350, 25)
Steering Wheel
Steering Wheel Lower No.2 Cover
Torx Screw
9.0 (90, 78 in.·lbf)
Combination Switch
Column Upper Cover
Torx Screw
9.0 (90, 78 in.·lbf)
8.0 (80, 69 in.·lbf)
Brake Pedal Return Spring
26 (260, 18)
26 (260, 18)
Steering Column Assembly
Column Lower Cover
Column Hole Cover No.2
35 (360, 26)
Universal Joint
Lower LH Finish Panel
8.0 (80, 69 in.·lbf)
Column Hole Cover
Hood Lock Release Lever
Fuel Lid Release Lever
Intermediate Shaft No.2
35 (360, 26)
N·m (kgf·cm, ft·lbf): Specified torque
No.2 Heater to Register Duct
86828g82

Fig. 76 Exploded view of the steering column — 1996 4Runner

To install:

14. Connect the universal joint No. 2.
    a. Insert the column hole cover and the column hole cover No. 2.
    b. Align the matchmarks on the column assembly and the universal joint No. 2.
    c. Tighten the bolt to 26 ft. lbs. (35 Nm).
15. Install the column assembly with the universal joint No. 2. Tighten the nuts to 18 ft. lbs. (26 Nm).
16. Install the column hole cover and the column hole cover No. 2. Tighten the five bolts to 5.9 ft. lbs. (8 Nm).
17. Install the intermediate shaft No. 2.
    a. Align the matchmarks on the universal joint No. 2 and the intermediate shaft No. 2.
    b. Align the matchmarks on the control valve shaft and the intermediate shaft No. 2.
    c. Tighten the A and B bolts to 26 ft. lbs. (35 Nm).
18. Install the brake pedal return spring.
19. Install the combination switch the with the spiral cable. Attach the air bag connector.
20. Install the upper and lower column covers.
21. Install the instrument lower finish panel. Connect the hood lock and the fuel lid control cables.
22. Center the spiral cable.
    a. Check that the front wheels are facing straight ahead.
    b. Turn the cable counterclockwise by hand until it becomes harder to turn the cable.
    c. Rotate the cable clockwise about three turns to align the red mark. The cable will rotate about three turns to either left or right of the center.
23. Install the steering wheel.
    a. Align the matchmarks on the wheel and mainshaft assembly.
    b. Attach the connector and tighten the wheel set nut to 25 ft. lbs. (34 Nm).
24. Attach the air bag connector.
25. Install the wheel pad after confirming that the circumference groove of the Torx® screws is caught on the screw case.
26. Using a Torx® driver, tighten the screws to 6.6 ft. lbs. (9 Nm).

➡If the wheel pad has been dropped or there are other defects, replace the wheel pad with a new one. Make sure that the wires do not interfere or are pinched between other parts when installing.

27. Connect the negative battery cable.
28. Enable the air bag system.
29. Road test the vehicle to check that the steering wheel is straight.

T100

♦ See Figures 77 and 78

1. Disconnect the negative battery cable.

✻✻CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Remove the steering wheel pad.
    a. Place the front wheels straight ahead.
    b. Remove the steering wheel lower No. 2 and No. 3 cover.
    c. Using a Torx® driver, loosen the Torx® screws. Loosen them until the groove along the screw circumference catches on the screw case.
    d. Pull out the wheel pad from the steering wheel and disconnect the air bag connector.

✻✻CAUTION

The air bag system (SRS) must be disarmed before removing the steering wheel. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Matchmark the steering wheel to the mainshaft. Using a steering wheel puller, remove the steering wheel.
4. Remove the upper and lower column covers.
5. Remove the instrument lower finish panel. Remove the hood release lever from the panel.
6. Remove the front door scuff plate and the cowl side trim. Remove the light control rheostat and locknut.
7. Remove the No. 2 heater register duct.
8. Remove the combination switch with the spiral cable. Unplug the two connectors and the air bag connector.
9. Remove the spiral cable.
10. If equipped with A/T, place matchmarks on the cap nut and the parking lock cable and remove the parking lock cable.
11. Disconnect the intermediate shaft assembly and the sliding with the shaft yoke sub-assembly.
    a. 4WD: Place matchmarks on the intermediate shaft and the worm gear valve shaft.
    b. 2WD: Place matchmarks on the intermediate shaft and the control valve shaft.
    c. Remove the bolts A, B and C.
12. Remove the intermediate shaft assembly and the sliding with the shaft yoke sub-assembly.
13. Remove the steering column assembly.
    a. A/T: Remove the locking wire, the bolt and the control shaft lever.
    b. Remove the two control shaft assembly mounting bolts from the steering column assembly.
    c. Remove the steering column assembly with the control shaft assembly.
    d. Remove the control shaft lever assembly from the steering column assembly.
    e. M/T: Remove the two steering column assembly set bolts and nuts.

To install:

14. Install the tilt steering column assembly.
    a. A/T: Install the control shaft assembly to the steering column assembly.
    b. Tighten the two steering column assembly set bolts and nuts to 19 ft. lbs. (25 Nm).
    c. Install the control shaft lever and tighten the bolt to 26 ft. lbs. (35 Nm).
    d. M/T: Tighten the two sheering column assembly set bolts to 19 ft. lbs. (25 Nm).

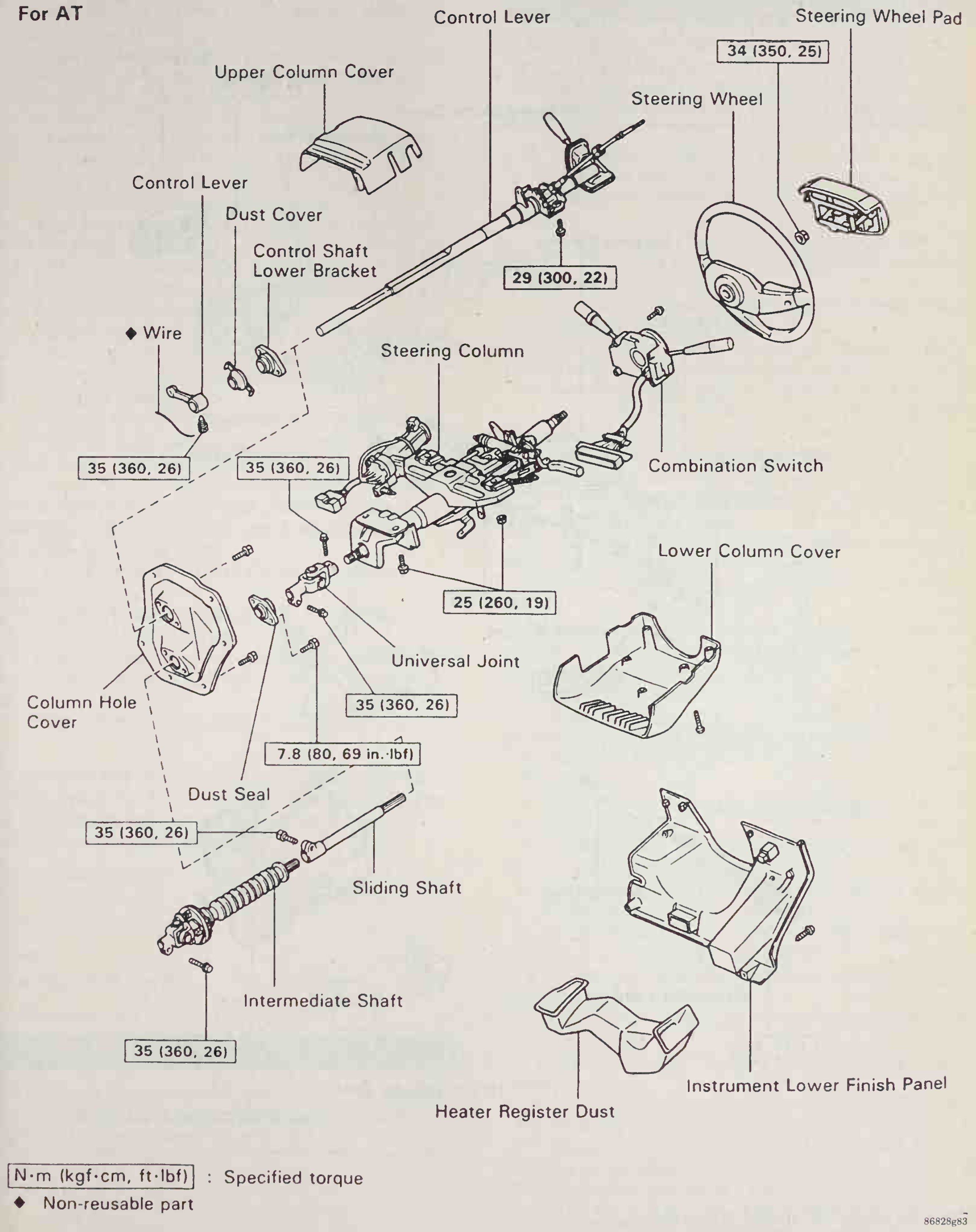

For AT
Control Lever
Steering Wheel Pad
34 (350, 25)
Upper Column Cover
Steering Wheel
Control Lever
Dust Cover
Control Shaft Lower Bracket
29 (300, 22)
◆ Wire
Steering Column
35 (360, 26)
35 (360, 26)
Combination Switch
Lower Column Cover
25 (260, 19)
Universal Joint
Column Hole Cover
35 (360, 26)
7.8 (80, 69 in.·lbf)
Dust Seal
35 (360, 26)
Sliding Shaft
Intermediate Shaft
35 (360, 26)
Instrument Lower Finish Panel
Heater Register Dust
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g83

Fig. 77 Exploded view of the steering column — T100 with automatic transmission

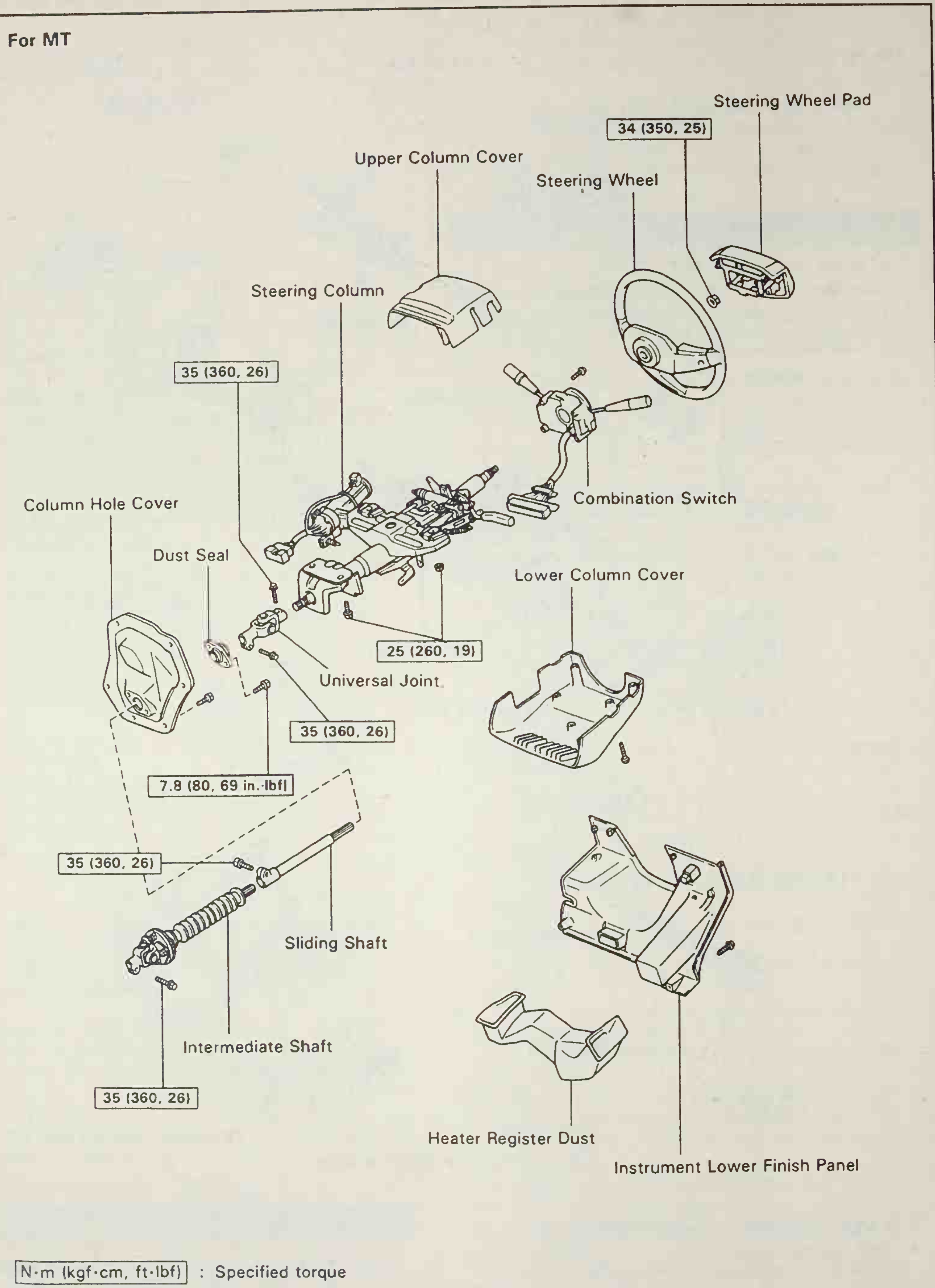

For MT
Steering Wheel Pad
34 (350, 25)
Upper Column Cover
Steering Wheel
Steering Column
35 (360, 26)
Combination Switch
Column Hole Cover
Dust Seal
Lower Column Cover
25 (260, 19)
Universal Joint
35 (360, 26)
7.8 (80, 69 in.·lbf)
35 (360, 26)
Sliding Shaft
Intermediate Shaft
35 (360, 26)
Heater Register Dust
Instrument Lower Finish Panel
N·m (kgf·cm, ft·lbf) : Specified torque
86828g84

Fig. 78 Exploded view of the steering column — T100 with manual transmission

15. Connect the intermediate shaft assembly and the sliding with shaft yoke sub-assembly.

a. Connect to the steering column assembly, tighten bolt C to 26 ft. lbs. (35 Nm).

b. On 4WD vehicles: Align the matchmarks on the intermediate shaft and the worm gear valve body assembly. Tighten bolt A to 26 ft. lbs. (35 Nm).

c. Tighten bolt B to 26 ft. lbs. (35 Nm).

16. If removed, connect and adjust the parking lock cable.

17. If removed, install the shift lever assembly and tighten the mounting bolts to 22 ft. lbs. (29 Nm).

18. If removed, install the parking lock cable.

19. Install the combination switch the with the spiral cable. Attach the air bag connector.

20. Install the duct heater to the register No. 2.

21. Install the front door scuff plate and the cowl side trim. Install the light control rheostat and the locknut.

22. Install the instrument lower finish panel. Install the hood release lever to the panel with the two screws.

23. Install the upper and lower column covers.

24. Center the spiral cable.

a. Check that the front wheels are facing straight ahead.

b. Turn the cable counterclockwise by hand until it becomes harder to turn the cable.

c. Rotate the cable clockwise about three turns to align the red mark. The cable will rotate about three turns to either left or right of the center.

25. Install the steering wheel.

a. Align the matchmarks on the wheel and mainshaft assembly.

b. Tighten the wheel set nut to 26 ft. lbs. (35 Nm).

26. Attach the air bag connector.

27. Install the wheel pad after confirming that the circumference groove of the Torx® screws is caught on the screw case.

28. Using a Torx® driver, tighten the screws to 7 ft. lbs. (9 Nm).

➡If the wheel pad has been dropped or there are other defects, replace the wheel pad with a new one. Make sure that the wires do not interfere and are not pinched between other parts when installing.

29. Connect the negative battery cable.

30. Road test the vehicle to check that the steering wheel is straight.

Tacoma

➧ See Figures 79 and 80

1. Disconnect the negative battery cable.

⁂CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Disarm the Supplemental Restraint System (SRS).

⁂CAUTION

The air bag system (SRS) must be disarmed before removing the steering wheel. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Remove the steering wheel pad.

a. Place the front wheels straight ahead.

b. Remove the steering wheel lower No. 2 and No. 3 cover.

c. Using a Torx® driver, loosen the Torx® screws. Loosen them until the groove along the screw circumference catches on the screw case.

d. Pull out the wheel pad from the steering wheel and disconnect the air bag connector.

4. Matchmark the steering wheel to the mainshaft. Using a steering wheel puller, remove the steering wheel.

5. Remove the upper and lower column covers.

6. Remove the instrument lower finish panel. Remove the hood release lever from the panel.

7. Remove the No. 2 heater register duct.

8. Remove the combination switch with the spiral cable.

a. Unplug the two connectors and the air bag connector.

9. Remove the spiral cable.

10. If equipped with column shift 2WD, disconnect the transmission control cable assembly.

a. Remove the two bolts and disconnect junction block No. 1.

b. Remove the pin and clip and disconnect the cable assembly from the column shift lever assembly.

11. 2WD: Remove the column hole cover.

12. 4WD: Remove the column hole cover No. 2.

13. Place matchmarks on the intermediate No. 2 shaft and the control valve shaft and remove the intermediate shaft.

14. Remove the steering column assembly.

To install:

15. Install the steering column assembly. Tighten the bolts to 19 ft. lbs. (26 Nm).

16. For the 2WD: install the intermediate No. 2 shaft and tighten bolts A and B to 27 ft. lbs. (36 Nm).

17. For the 2WD: Install the column hole cover and tighten the bolts to 6 ft. lbs. (8 Nm).

18. For the 4WD: install the intermediate No. 2 shaft and tighten bolts A and B to 26 ft. lbs. (35 Nm).

19. For the 4WD: Install the column hole cover No. 2 and tighten the bolts to 6 ft. lbs. (8 Nm).

20. For the 2WD column shift, connect the transmission control cable assembly.

a. Connect the cable assembly to the column shift lever assembly.

b. Install the pin and clip and connect the junction block No. 1 with the two bolts.

21. Install the combination switch the with the spiral cable. Attach the air bag connector.

22. Install the duct heater to the register No. 2.

23. Install the instrument lower finish panel. Install the hood release lever to the panel with the two screws.

24. Install the upper and lower column covers.

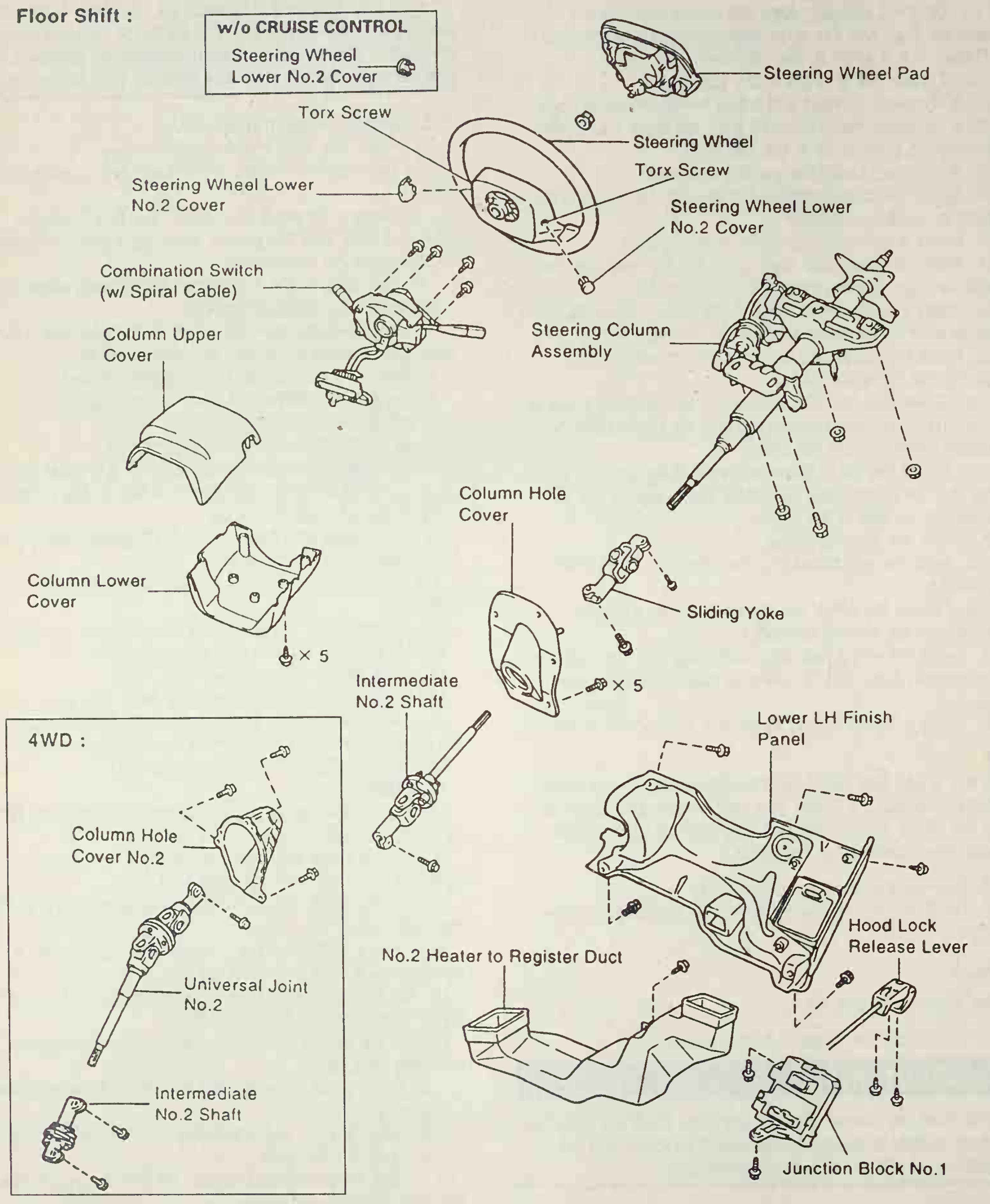

Floor Shift :
w/o CRUISE CONTROL
Steering Wheel Lower No.2 Cover
Steering Wheel Pad
Torx Screw
Steering Wheel
Torx Screw
Steering Wheel Lower No.2 Cover
Steering Wheel Lower No.2 Cover
Combination Switch (w/ Spiral Cable)
Column Upper Cover
Steering Column Assembly
Column Hole Cover
Column Lower Cover
× 5
Sliding Yoke
Intermediate No.2 Shaft
× 5
Lower LH Finish Panel
4WD :
Column Hole Cover No.2
Universal Joint No.2
Intermediate No.2 Shaft
No.2 Heater to Register Duct
Hood Lock Release Lever
Junction Block No.1
86828g86

Fig. 79 Exploded view of the steering column — Tacoma with floor shifter

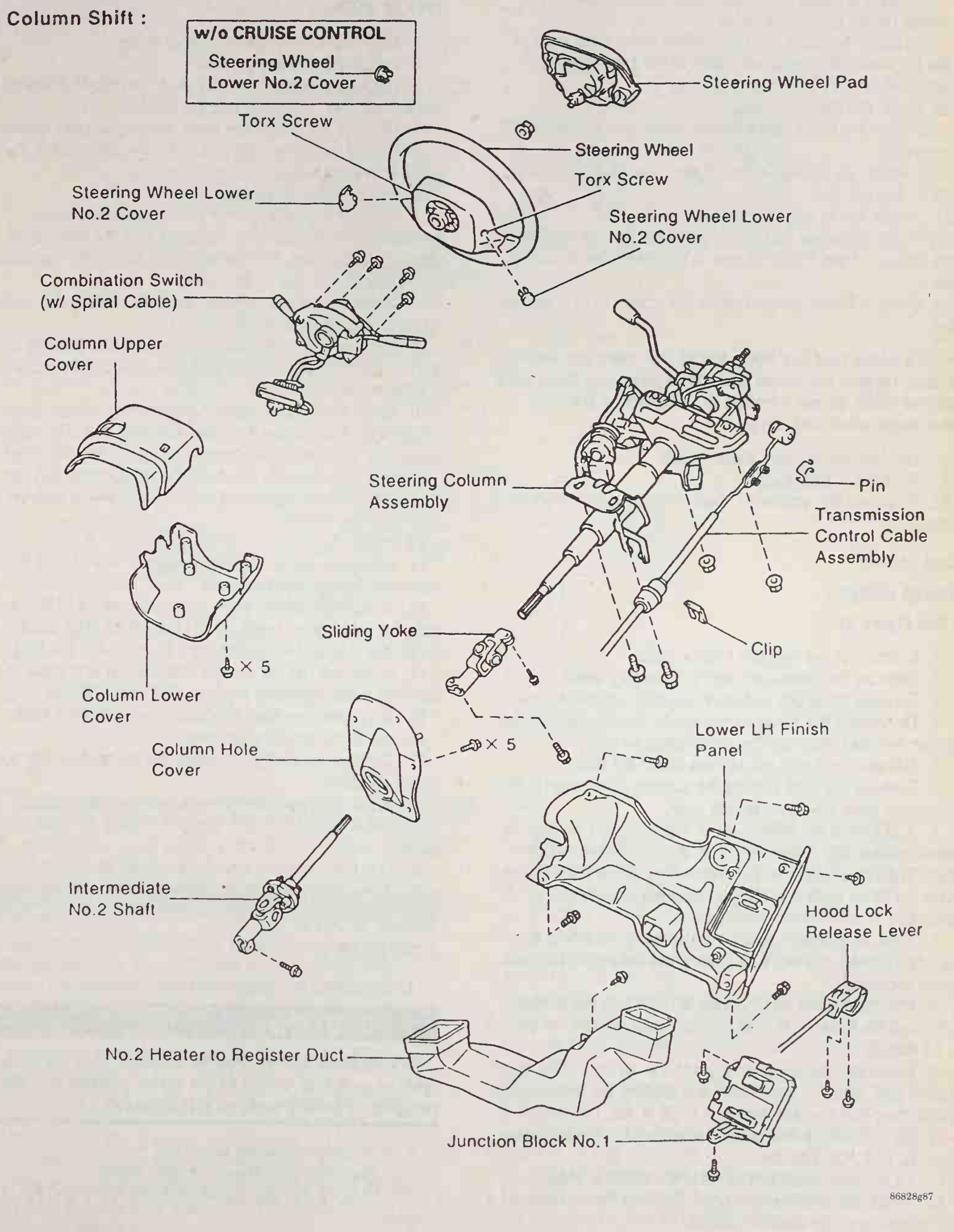

Column Shift :
w/o CRUISE CONTROL
Steering Wheel Lower No.2 Cover
Steering Wheel Pad
Torx Screw
Steering Wheel
Torx Screw
Steering Wheel Lower No.2 Cover
Steering Wheel Lower No.2 Cover
Combination Switch (w/ Spiral Cable)
Column Upper Cover
Steering Column Assembly
Pin
Transmission Control Cable Assembly
Clip
Sliding Yoke
× 5
Column Lower Cover
Column Hole Cover
× 5
Lower LH Finish Panel
Intermediate No.2 Shaft
Hood Lock Release Lever
No.2 Heater to Register Duct
Junction Block No.1
86828g87

Fig. 80 Exploded view of the steering column — Tacoma with column shifter

25. Center the spiral cable.
   a. Check that the front wheels are facing straight ahead.
   b. Turn the cable counterclockwise by hand until it becomes harder to turn the cable.
   c. Rotate the cable clockwise about three turns to align the red mark. The cable will rotate about three turns to either left or right of the center.
26. Install the steering wheel.
   a. Align the matchmarks on the wheel and mainshaft assembly.
   b. Attach the connector and tighten the wheel set nut to 26 ft. lbs. (35 Nm).
27. Attach the air bag connector.
28. Install the wheel pad after confirming that the circumference groove of the Torx® screws is caught on the screw case.
29. Using a Torx® driver, tighten the screws to 7 ft. lbs. (9 Nm).

➡If the wheel pad has been dropped or there are other defects, replace the wheel pad with a new one. Make sure that the wires do not interfere or are pinched between other parts when installing.

30. Connect the negative battery cable.
31. Enable the SRS system.
32. Road test the vehicle to check that the steering wheel is straight.

Land Cruiser

1989-90 MODELS

➧ See Figure 81

1. Disconnect the negative battery cable.
2. Remove the center pad and the steering wheel.
3. Remove the upper and lower steering column covers.
4. Disconnect the wiring harnesses for the combination and ignition switches. Remove the combination switch.
5. Remove the lower left air duct under the dash.
6. Remove the bolts holding the steering hole cover to the floorboard. Slide the cover up the shaft.
7. Just behind the hole cover is a flexible joint holding the upper intermediate steering shaft to the lower intermediate shaft. The pinch bolt is at the engine side of the joint; matchmark the lower shaft and the joint. Loosen or remove the pinch bolt.
8. Have an assistant support the steering column in the vehicle. Remove the two nuts holding the column to the dashboard subframe.
9. Pull the column into the vehicle, releasing the flexible joint from the lower shaft. Remove the column from the cab.

To install:

10. Install the column assembly into the vehicle, fitting the flexible joint onto the lower shaft and aligning the matchmarks. Install the pinch bolt and tighten it to 26 ft. lbs. (35 Nm).
11. Lift the column into position and install the nuts; tighten them to 18 ft. lbs. (25 Nm).
12. Fit the hole cover into place and install the bolts.
13. Install the combination switch. Connect the harnesses for the ignition and combination switches.
14. Install the under dash air duct.
15. Install the upper and lower steering column covers.
16. Install the steering wheel and center pad.
17. Connect the negative battery cable.

1991-94 MODELS

1. Disconnect the negative battery cable.
2. Remove the steering wheel.
3. Remove the lower left side dash trim panel. Remove the heater duct (No. 1) from below the dash.
4. Remove the upper and lower steering column covers.
5. Unplug the wiring connectors for the combination switch and the ignition switch.
6. Remove the combination switch.
7. Below the vehicle, at the steering gearbox, make matchmarks on the steering mainshaft and the worm shaft entering the gearbox. Disconnect the bolts holding the coupling to the worm gear and to the shaft.
8. Inside the vehicle, remove the bolts holding the rubber steering hole cover to the floorboard.
9. Remove one of the two bolts holding the steering column to the instrument panel subframe. Remove the nut(s) holding the column.
10. Have an assistant support the steering column inside the vehicle before removing the other mounting bolt. The column is heavy and will come down heavily on you if not supported.
11. Pull the assembly into the vehicle, disconnecting the mainshaft from the steering gearbox. Remove the steering column from the vehicle.

To install:

12. Place the column assembly into the vehicle and fit the mainshaft through the floor hole.
13. Under the vehicle, align the matchmarks and fit the shaft onto the worm gear. Make certain the marks align exactly. Install the 2 bolts and tighten them to 25 ft. lbs. (34 Nm).
14. In the cab, lift the column into position and install the retaining bolts, tightening them to 19 ft. lbs. (25 Nm).
15. Reposition the floor hole cover and install the bolts.
16. Install the combination switch.
17. Connect the wiring harnesses for the ignition and combination switches.
18. Install the upper and lower steering column covers.
19. Install the heater duct; install the lower left dash trim panel.
20. Install the steering wheel and center pad.
21. Connect the negative battery cable.

1995-96 MODELS

➧ See Figure 82

1. Disconnect the negative battery cable.

✲✲CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

2. Remove the steering wheel pad.
   a. Place the front wheels straight ahead.
   b. Remove the steering wheel lower No. 2 and No. 3 cover.
   c. Using a Torx® driver, loosen the Torx® screws. Loosen them until the groove along the screw circumference catches on the screw case.

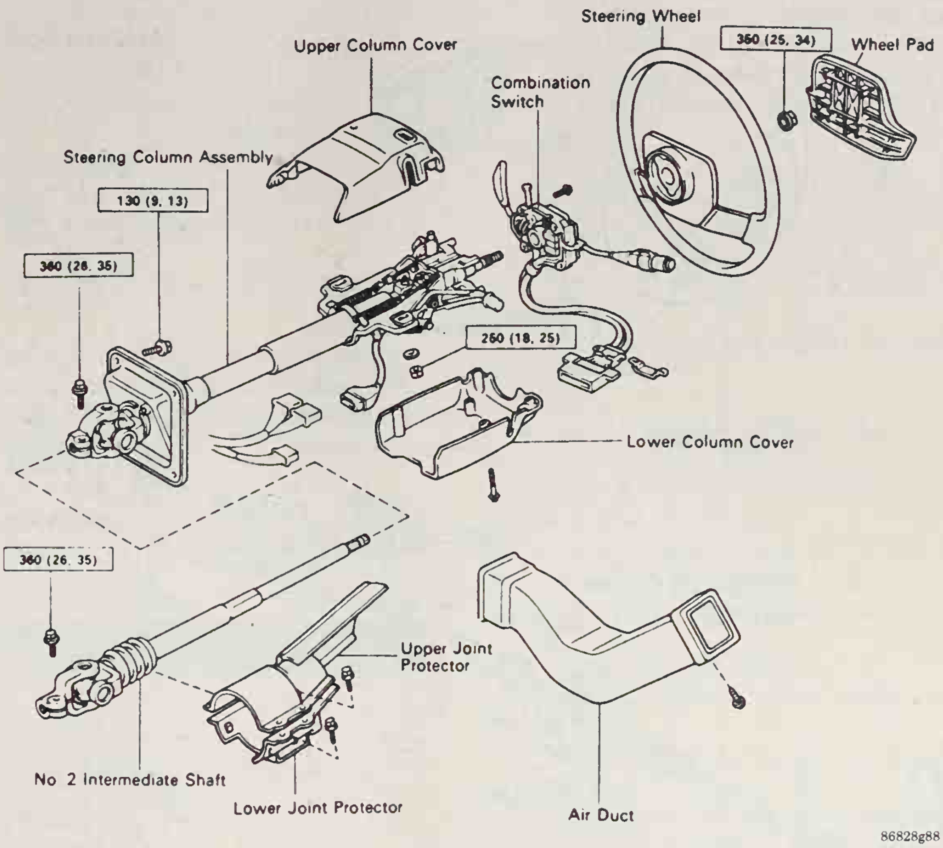

Steering Wheel
360 (25, 34)
Wheel Pad
Upper Column Cover
Combination Switch
Steering Column Assembly
130 (9, 13)
360 (26, 35)
260 (18, 25)
Lower Column Cover
360 (26, 35)
Upper Joint Protector
No 2 Intermediate Shaft
Lower Joint Protector
Air Duct
86828g88

Fig. 81 Exploded view of the steering column — 1989-90 Land Cruiser

d. Pull out the wheel pad from the steering wheel and disconnect the air bag connector.

⁂CAUTION

The air bag system (SRS) must be disarmed before removing the steering wheel. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Matchmark the steering wheel to the mainshaft. Using a steering wheel puller, remove the steering wheel.
4. Remove the instrument lower finish panel. Disconnect the hood lock control cable and fuel lid control cable.
5. Remove the No. 2 heater register duct.
6. Remove the upper and lower column covers.
7. Remove the combination switch with the spiral cable. Unplug the two connectors and the air bag connector.
8. Remove the spiral cable.
9. Remove the four column hole cover set bolts.
10. Remove the link joint protector.
11. Place matchmarks on the sliding yoke sub-assembly and the worm gear valve body shaft. Loosen bolt A and remove bolt B. Remove the yoke sub-assembly.
12. Remove the tilt steering column assembly.

To install:

13. Install the tilt steering column assembly. Tighten the bolts to 18 ft. lbs. (25 Nm).
14. Align the matchmarks and connect the sliding yoke sub-assembly. Tighten bolts A and B to 25 ft. lbs. (34 Nm).
15. Install the link joint protector. Tighten the bolts to 9 ft. lbs. (12 Nm).
16. Tighten the four column hole cover set bolts to 9 ft. lbs. (12 Nm).
17. Install the combination switch the with the spiral cable. Attach the air bag connector.
18. Install the upper and lower column covers.
19. Install the instrument lower finish panel. Connect the hood lock and the fuel lid control cables.
20. Center the spiral cable.
    a. Check that the front wheels are facing straight ahead.

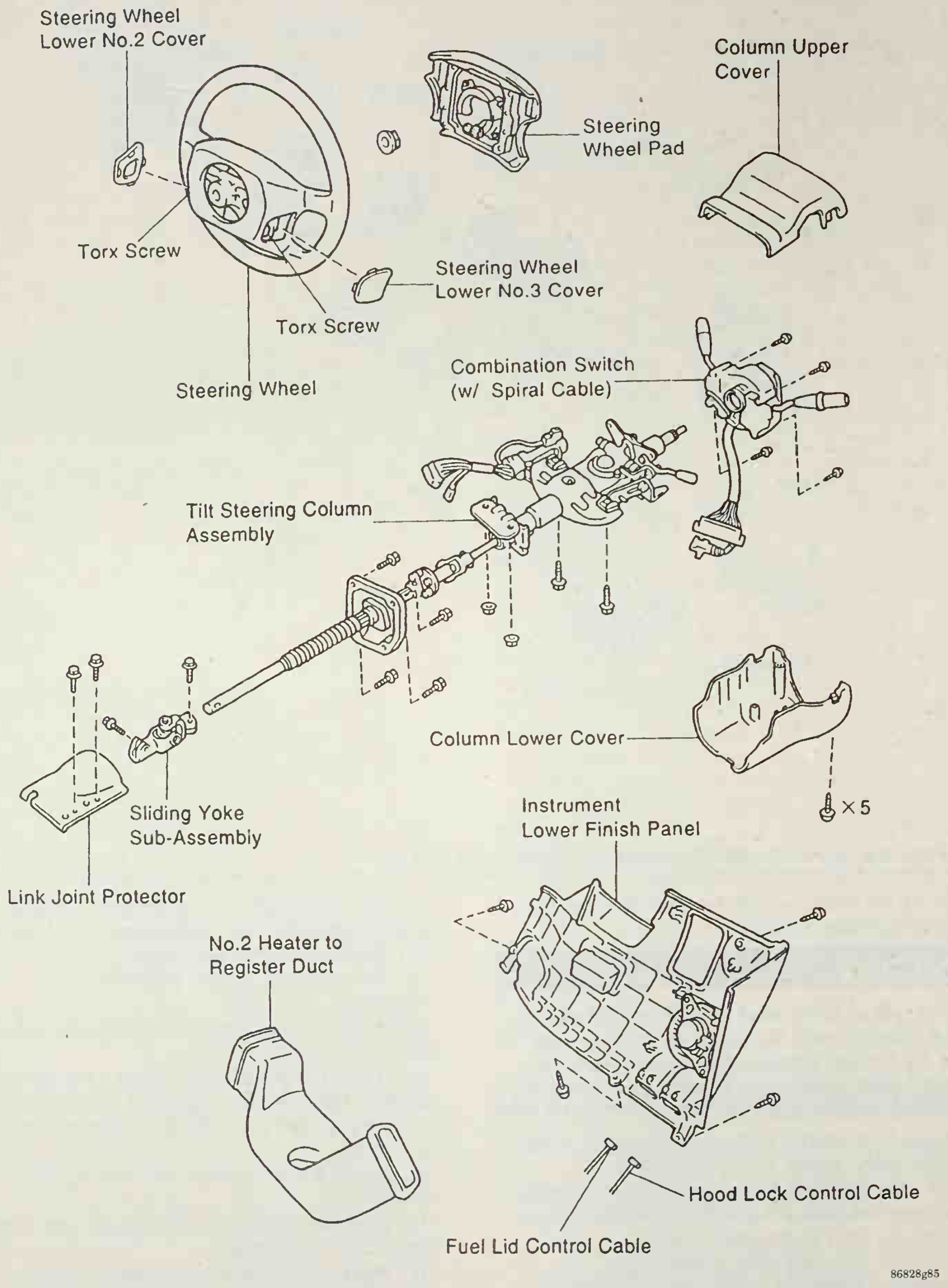

Steering Wheel Lower No.2 Cover
Column Upper Cover
Steering Wheel Pad
Torx Screw
Steering Wheel Lower No.3 Cover
Torx Screw
Steering Wheel
Combination Switch (w/ Spiral Cable)
Tilt Steering Column Assembly
Column Lower Cover
Sliding Yoke Sub-Assembly
Link Joint Protector
Instrument Lower Finish Panel
×5
No.2 Heater to Register Duct
Hood Lock Control Cable
Fuel Lid Control Cable
86828g85

Fig. 82 Exploded view of the steering column — 1995-96 Land Cruiser

b. Turn the cable counterclockwise by hand until it becomes harder to turn the cable.

c. Rotate the cable clockwise about three turns to align the red mark. The cable will rotate about three turns to either left or right of the center.

21. Install the steering wheel.

a. Align the matchmarks on the wheel and mainshaft assembly.

b. Attach the connector and tighten the wheel set nut to 25 ft. lbs. (34 Nm).

22. Attach the air bag connector.

23. Install the wheel pad after confirming that the circumference groove of the Torx® screws is caught on the screw case.

24. Using a Torx® driver, tighten the screws to 7 ft. lbs. (9 Nm).

➡If the wheel pad has been dropped or there are other defects, replace the wheel pad with a new one. Make sure that the wires do not interfere or are pinched between other parts when installing.

25. Connect the negative battery cable.

26. Enable the air bag system.

27. Road test the vehicle to check that the steering wheel is straight.

Steering Linkage

REMOVAL & INSTALLATION

2WD Pick-Up

➧ See Figure 83

➡Before working on any of the following steering linkage components, disconnect the battery cable, raise the front of the truck and support it with safety stands.

PITMAN ARM

1. Remove the strut bar.
2. Loosen the Pitman arm nut.
3. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the sector shaft.
4. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the relay rod.

To install:

5. Align the marks on the Pitman arm and sector shaft and connect them. Tighten the nut to 90 ft. lbs. (123 Nm).
6. Connect the arm to the relay rod and tighten the nut to 67 ft. lbs. (90 Nm).
7. Install the strut bar.

TIE ROD

1. Using a tie rod end puller, disconnect the tie rod from the relay rod.
2. Using a tie rod end puller, disconnect the tie rod from the knuckle arm.
3. Remove the tie rod and remove the tie rod ends.

To install:

4. Screw the tie rod ends onto the tie rod. The tie rod length should be approximately (314.5mm). The remaining length of threads on both ends should always be equal.
5. Turn the tie rod ends so they cross at about 90°. Tighten the clamp nuts to 19 ft. lbs. (25 Nm).
6. Connect the tie rod to the knuckle arm and relay rod and tighten the mounting nuts to 67 ft. lbs. (90 Nm).

RELAY ROD

1. Disconnect the tie rod ends from the relay rod.
2. Using a tie rod end puller, disconnect the Pitman arm from the relay rod.
3. Using a tie rod end puller, disconnect the idler arm from the relay rod.
4. Remove the rod and inspect it for cracks or other damage.

To install:

5. Connect the relay rod to the idler arm to the relay rod and tighten the nut 43 ft. lbs. (59 Nm).
6. Connect the relay rod to the Pitman arm, then tighten the nut to 67 ft. lbs. (90 Nm).
7. Connect the tie rod ends to the relay rod, then tighten the nuts to 67 ft. lbs. (90 Nm).

KNUCKLE ARM

1. Remove the front axle hub.
2. Separate the tie rod at the knuckle arm, then remove the arm.
3. Inspect the arm for cracks or other damage.

To install:

4. Install the arm to the steering knuckle and tighten the nut to 80 ft. lbs. (108 Nm).
5. Connect the tie rod to the knuckle arm, then tighten the nut to 67 ft. lbs. (90 Nm).
6. Install the front axle hub.

STEERING DAMPER

1. Separate the steering damper at the relay rod.
2. Disconnect the damper at the frame, then remove the damper with all washers and cushions.

To install:

3. Install the damper to the frame bracket and tighten the nut to 9 ft. lbs. (13 Nm).
4. Connect the other end of the steering damper to the relay rod, then tighten the nut to 43 ft. lbs. (59 Nm).

IDLER ARM

1. Separate the relay rod from the idler arm.
2. Remove the 3 mounting bolts and remove the idler arm bracket with the arm attached.

To install:

3. Position the bracket and arm on the frame and tighten the bolts to 48-58 ft. lbs. (65-78 Nm).
4. Connect the idler arm to the relay rod, then tighten the nut to 43 ft. lbs. (59 Nm).

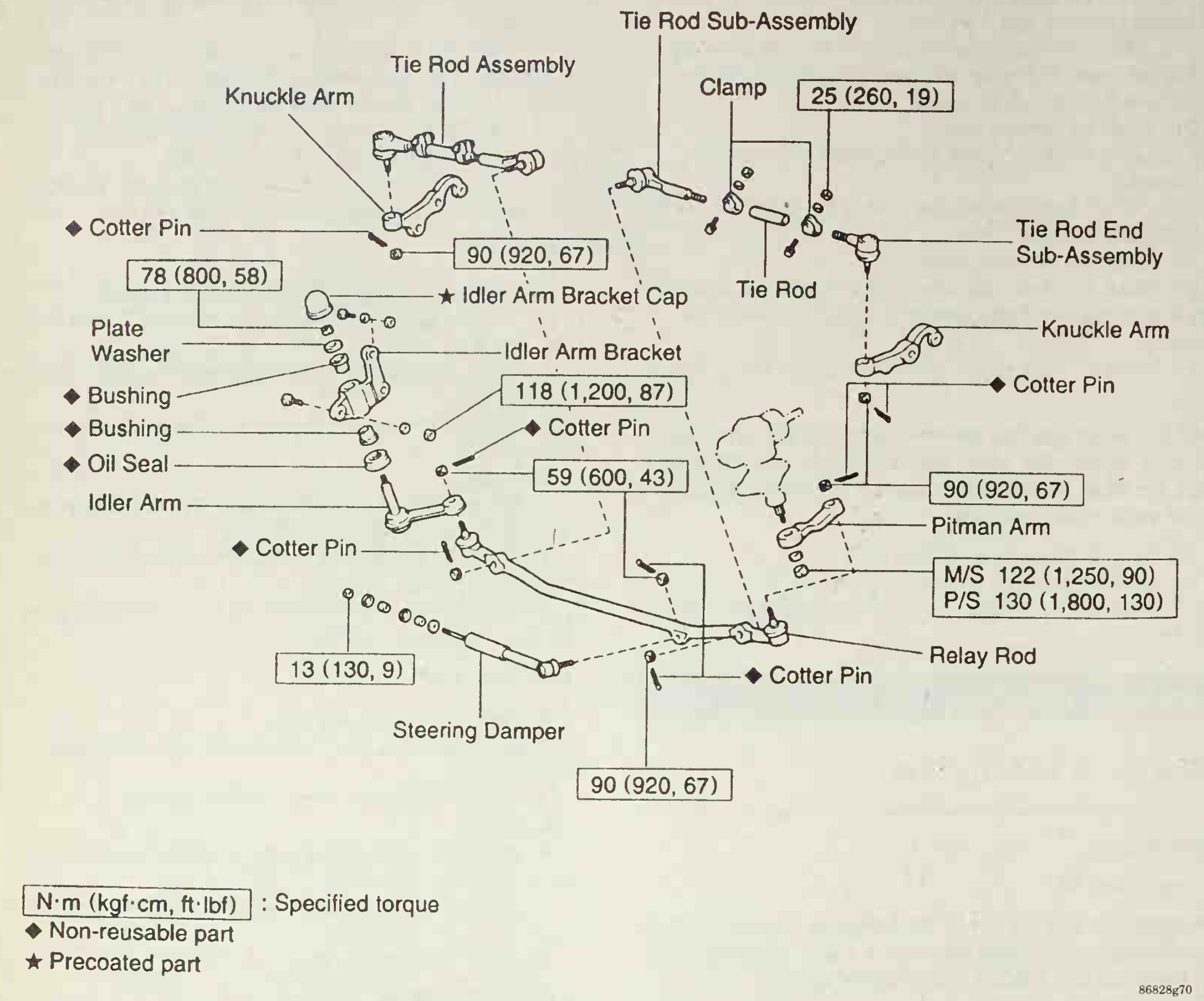

Tie Rod Sub-Assembly
Tie Rod Assembly
Knuckle Arm
Clamp
25 (260, 19)
◆ Cotter Pin
90 (920, 67)
Tie Rod End Sub-Assembly
78 (800, 58)
★ Idler Arm Bracket Cap
Tie Rod
Plate
Washer
Idler Arm Bracket
Knuckle Arm
◆ Bushing
118 (1,200, 87)
◆ Cotter Pin
◆ Bushing
◆ Cotter Pin
◆ Oil Seal
59 (600, 43)
90 (920, 67)
Idler Arm
Pitman Arm
◆ Cotter Pin
M/S 122 (1,250, 90)
P/S 130 (1,800, 130)
13 (130, 9)
Relay Rod
◆ Cotter Pin
Steering Damper
90 (920, 67)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part
86828g70

Fig. 83 Exploded view of the 2WD Pick-Up and 4Runner steering linkage components

4WD Pick-Up and 4Runner

➧ See Figure 84

➡Before working on any of the following steering linkage components, raise the front of the truck and support it with safety stands.

PITMAN ARM

1. Remove the Pitman arm set nut and washer.
2. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the sector shaft.
3. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the relay rod.

To install:

4. Align the marks on the Pitman arm and sector shaft and connect them. Tighten the nut to 130 ft. lbs. (177 Nm).
5. Attach the arm to the relay rod, then tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin.

TIE ROD

1. Using a tie rod end puller, disconnect the tie rod from the relay rod.
2. Using a tie rod end puller, disconnect the tie rod from the knuckle arm.
3. Remove the tie rod and remove the tie rod ends.

To install:

4. Screw the tie rod ends onto the tie rod. The tie rod length should be approximately 12.38 in. (314.5mm). The remaining length of threads on both ends should always be equal.
5. Turn the tie rod ends so they cross at about 90°. Tighten the clamp nuts to 19 ft. lbs. (25 Nm).
6. Attach the tie rod to the knuckle arm and relay rod, then tighten the mounting nuts to 67 ft. lbs. (90 Nm).

RELAY ROD

1. Separate the tie rod ends from the relay rod.
2. Using a tie rod end puller, disconnect the PITMAN arm from the relay rod.

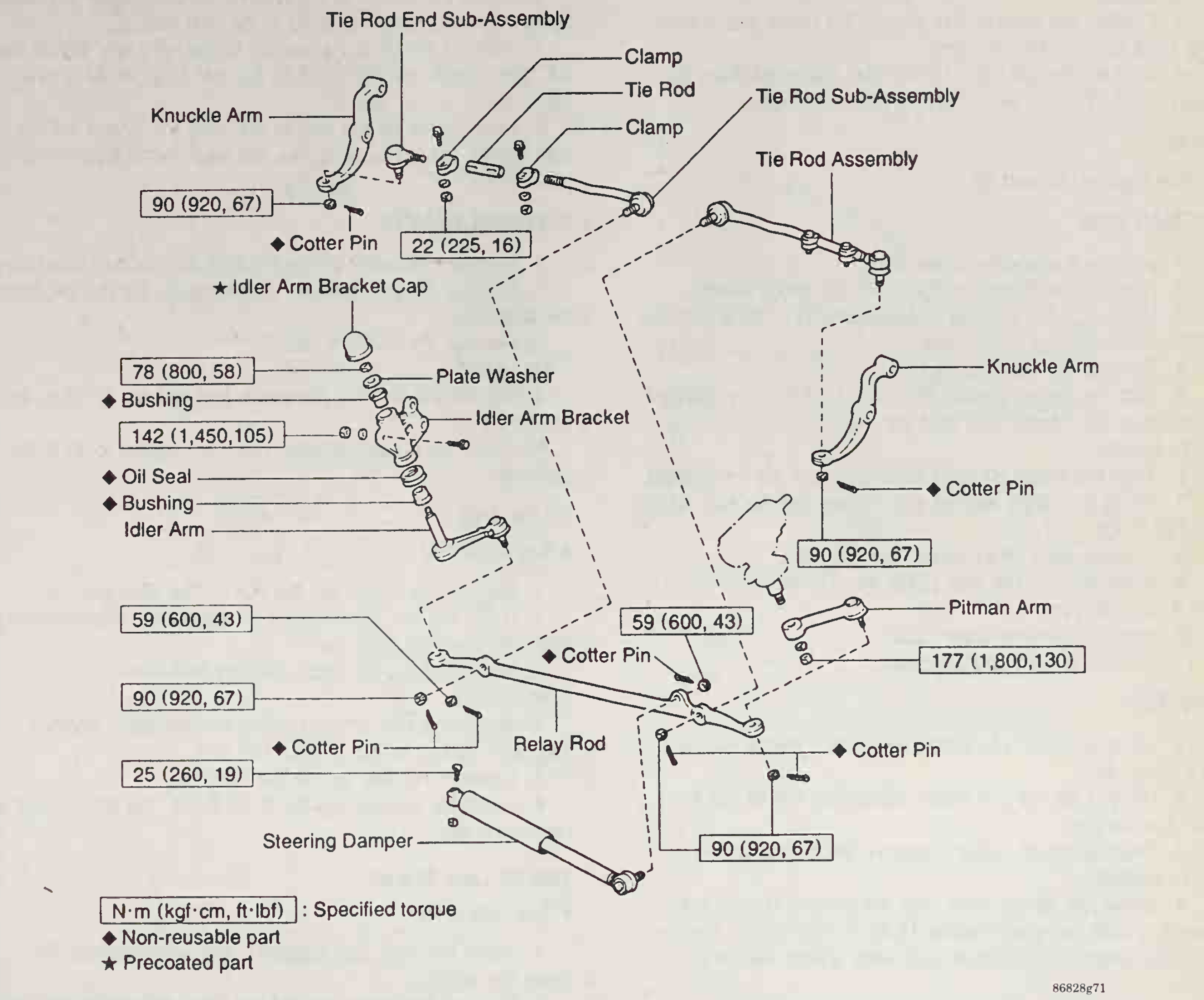

Tie Rod End Sub-Assembly
Clamp
Tie Rod
Clamp
Tie Rod Sub-Assembly
Knuckle Arm
Tie Rod Assembly
90 (920, 67)
◆ Cotter Pin
22 (225, 16)
★ Idler Arm Bracket Cap
78 (800, 58)
Plate Washer
◆ Bushing
Idler Arm Bracket
142 (1,450,105)
◆ Oil Seal
◆ Bushing
Idler Arm
Knuckle Arm
◆ Cotter Pin
90 (920, 67)
Pitman Arm
59 (600, 43)
59 (600, 43)
◆ Cotter Pin
177 (1,800,130)
90 (920, 67)
◆ Cotter Pin
Relay Rod
◆ Cotter Pin
25 (260, 19)
Steering Damper
90 (920, 67)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part
86828g71

Fig. 84 Exploded view of the 4WD Pick-Up and 4Runner steering linkage components

3. Using a tie rod end puller, disconnect the idler arm from the relay rod.

4. Remove the rod and inspect it for cracks or other damage.

5. Remove the cotter pin and set nut and then disconnect the steering damper from the relay rod.

To install:

6. Connect the relay rod to the idler arm to the relay rod, then tighten the nut 43 ft. lbs. (59 Nm). Install a new cotter pin.

7. Connect the relay rod to the Pitman arm, then tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin.

8. Connect the tie rod ends to the relay rod, then tighten the nuts to 67 ft. lbs. (90 Nm). Install new cotter pins.

9. Connect the steering damper to the relay rod, then tighten the nut to 43 ft. lbs. (50 Nm). Install a new cotter pin.

KNUCKLE ARM

1. Separate the tie rod at the knuckle arm and remove the arm.

2. Inspect the arm for cracks or other damage.

To install:

3. Install the arm to the steering knuckle and tighten the nut to 120 ft. lbs. (162 Nm).

4. Connect the tie rod to the knuckle arm, then tighten the nut to 67 ft. lbs. (90 Nm).

STEERING DAMPER

1. Separate the steering damper at the relay rod.

2. Disconnect the damper at the frame, then remove the damper with all washers and cushions.

To install:

3. Install the damper to the frame bracket and tighten the nut to 9 ft. lbs. (13 Nm).

4. Connect the other end of the steering damper to the relay rod and tighten the nut to 43 ft. lbs. (59 Nm). Install a new cotter pin.

IDLER ARM BRACKET

1. Separate the relay rod from the idler arm.

2. Remove the 3 mounting bolts and remove the idler arm bracket with the arm attached.

To install:

3. Position the bracket and arm on the frame and tighten the bolts to 70 ft. lbs. (95 Nm).
4. Connect the idler arm to the relay rod and tighten the nut to 43 ft. lbs. (59 Nm). Install a new cotter pin.

T100

➧ **See Figures 85 and 86**

PITMAN ARM

1. Remove the engine under cover.
2. Remove the Pitman arm set nut and spring washer.
3. Using a puller such as tool 09628-62011, disconnect the Pitman arm from he cross shaft.
4. Remove the cotter pin and nut.
5. With the aid of another SST 09611-22012 or equivalent, disconnect the Pitman arm from the relay rod.

To install:

6. Align the marks on the Pitman arm and the cross shaft.
7. Install the spring washer and Pitman arm set nut, tighten to 130 ft. lbs. (177 Nm).
8. Connect the Pitman arm to the relay rod.
9. Install the nut and new cotter pin. Tighten the the nut to 67 ft. lbs. (90 Nm).
10. Install the engine under cover.
11. Check the front end alignment.

TIE ROD

1. Using a tie rod end puller, disconnect the tie rod from the relay rod.
2. Using a tie rod end puller, disconnect the tie rod from the knuckle arm.
3. Remove the tie rod and remove the tie rod ends.

To install:

4. Screw the tie rod ends onto the tie rod. The tie rod length should be approximately 12.96 in. (329.2mm). The remaining length of threads on both ends should always be equal.
5. Turn the tie rod ends so they cross at about 90°. Tighten the clamp nuts to 16 ft. lbs. (22 Nm).
6. Attach the tie rod to the knuckle arm and relay rod, then tighten the mounting nuts to 67 ft. lbs. (90 Nm).
7. Connect the tie rod assembly to the relay rod. Install the nut, then tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin.
8. Connect the tie rod end to the relay rod. Install the nut, then tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin.

STEERING DAMPER

1. Remove the cotter pin and nut on the damper assembly.
2. Using a damper remover, and separate the damper from the relay rod.
3. Remove the bolt and nut.

To install:

4. Tighten the steering dampener bolt and nut to 19 ft. lbs. (25 Nm).
5. Install the nut and a new cotter pin, tighten to 43 ft. lbs. (59 Nm).

IDLER ARM

➧ **See Figure 87**

1. Remove the cotter pin and nut for the idler arm.
2. Using the tool 09610-20012 or equivalent, disconnect the idler arm from the relay rod.
3. Remove the three bolts, washers and nuts.

To install:

4. Attach the idler arm assembly with the bolts, washers and nuts, tighten to 105 ft. lbs. (142 Nm).
5. Connect the idler arm to the relay rod.
6. Install the nut and tighten to 43 ft. lbs. (59 Nm). Install a new cotter pin.

1989-90 Land Cruiser

➧ **See Figure 88**

1. Raise the truck and support it with safety stands. Remove the wheels.
2. Remove the cotter pin and nut, then disconnect the relay rod at the Pitman arm.

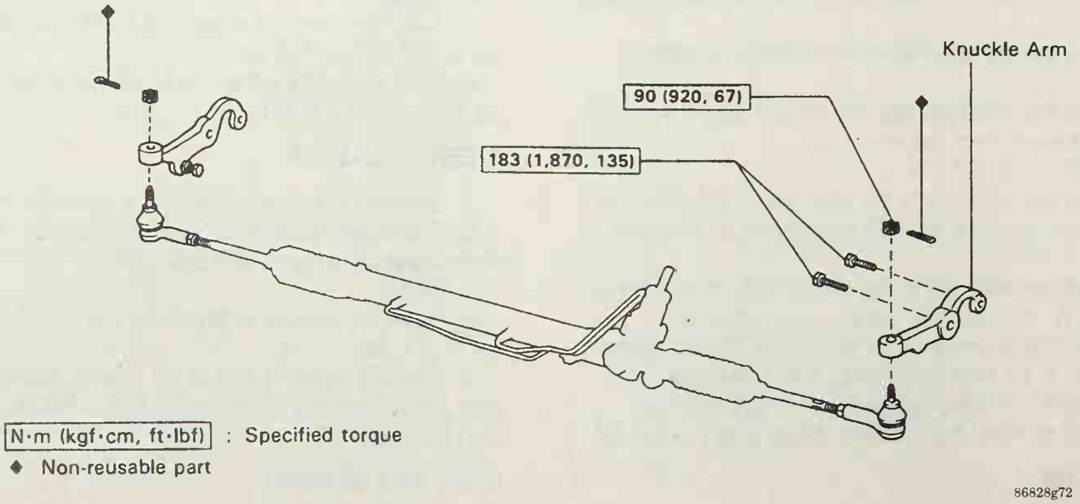


Fig. 85 Exploded view of the 2WD T100 steering linkage components

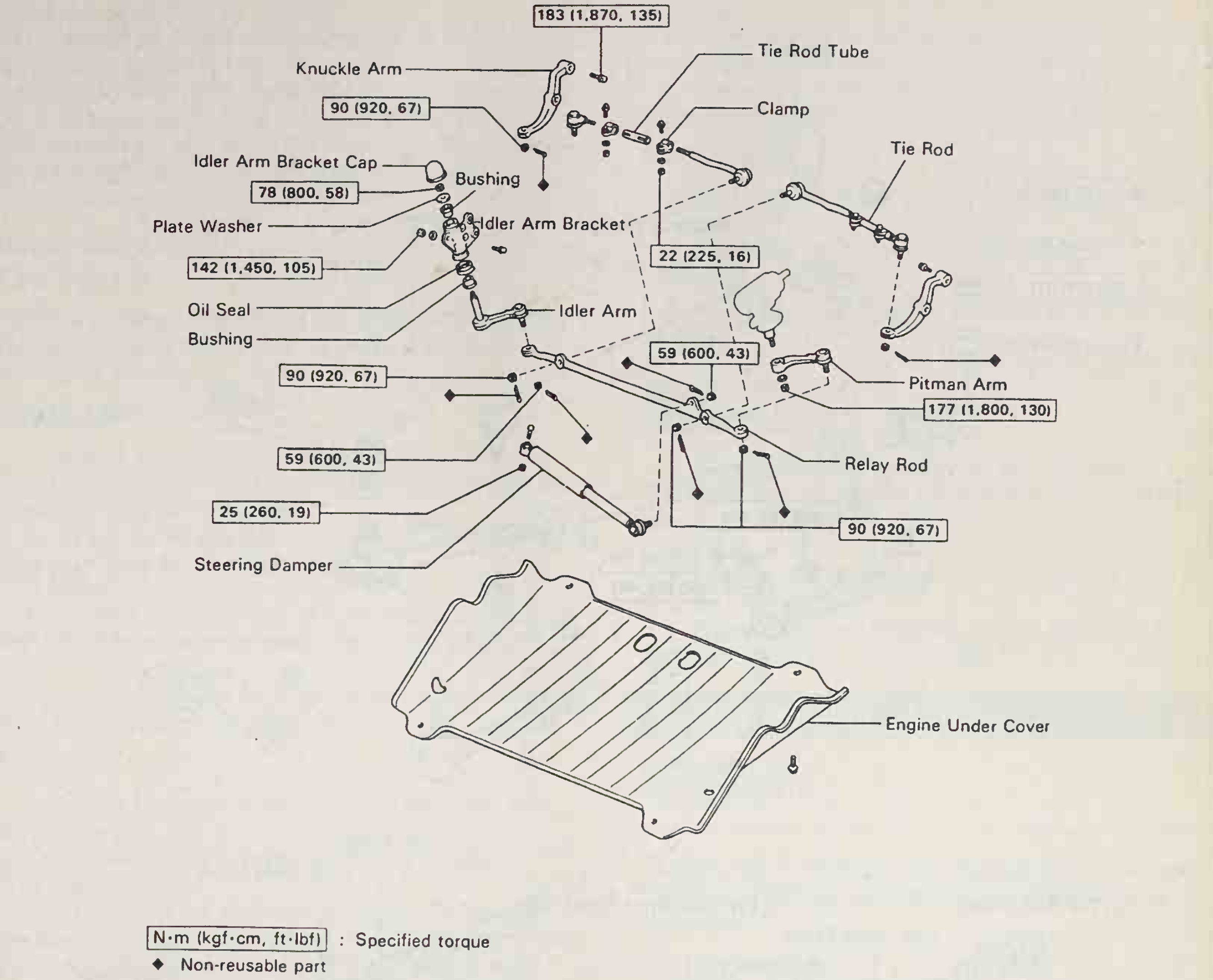

183 (1,870, 135)
Tie Rod Tube
Knuckle Arm
90 (920, 67)
Clamp
Tie Rod
Idler Arm Bracket Cap
Bushing
78 (800, 58)
Plate Washer
Idler Arm Bracket
22 (225, 16)
142 (1,450, 105)
Oil Seal
Idler Arm
Bushing
59 (600, 43)
90 (920, 67)
Pitman Arm
177 (1,800, 130)
59 (600, 43)
Relay Rod
25 (260, 19)
90 (920, 67)
Steering Damper
Engine Under Cover
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g74

Fig. 86 Exploded view of the 4WD T100 steering linkage components

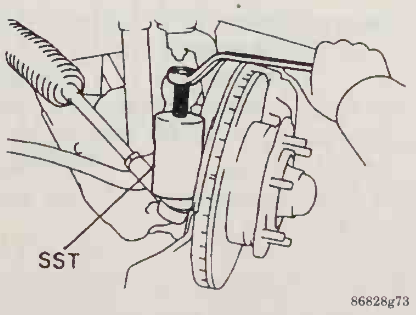

SST
86828g73

Fig. 87 Tool 09610-20012 or equivalent can be used to separate the idler arm from the knuckle and the tie rod from the knuckle

3. Remove the cotter pin and nut, then disconnect the tie rod at the knuckle arm.

4. Remove the mounting nut, then disconnect the steering damper at the frame bracket.

5. Remove the nut, then disconnect the steering damper at the relay rod.

6. Remove the cotter pin and nut, then disconnect the relay rod at the tie rod.

To install:

7. To replace the tie rod ends, loosen the clamp and remove the ends. Install the ends, then turn them in so they are approximately 47.5 in. (121cm) apart. Tighten the clamps.

8. To replace the relay rod ends, loosen the end clamps and remove the ends. Remove the cotter pin. Remove the plug, 2 ball stud seats, link joint knob, spring and spring seat. Coat the parts with grease, install them and tighten the plug completely. Loosen the plug 1-1⅓ turns and install a new cotter pin. Turn the rod ends onto the rod so they are 37.8 in. (96cm) apart. Tighten the clamp bolts to 33 ft. lbs. (44 Nm).

9. Connect the relay rod to the tie rod, then tighten the nut to 67 ft. lbs. (90 Nm) and install a new cotter pin.

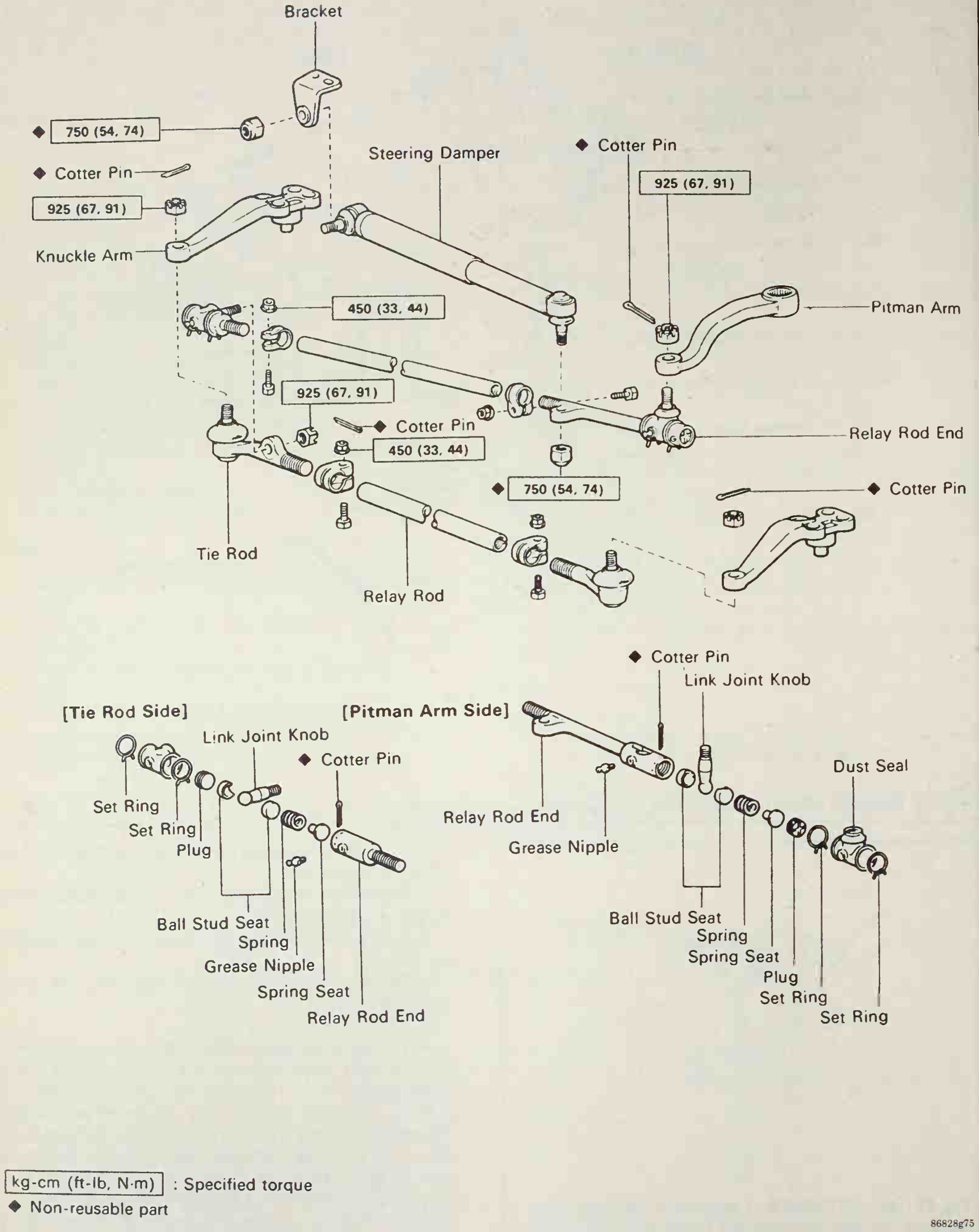

Bracket
◆ 750 (54, 74)
◆ Cotter Pin
925 (67, 91)
Knuckle Arm
Steering Damper
◆ Cotter Pin
925 (67, 91)
Pitman Arm
450 (33, 44)
925 (67, 91)
◆ Cotter Pin
450 (33, 44)
Relay Rod End
◆ 750 (54, 74)
◆ Cotter Pin
Tie Rod
Relay Rod
[Tie Rod Side]
[Pitman Arm Side]
◆ Cotter Pin
Link Joint Knob
Link Joint Knob
◆ Cotter Pin
Set Ring
Set Ring
Plug
Ball Stud Seat
Spring
Grease Nipple
Spring Seat
Relay Rod End
Relay Rod End
Grease Nipple
Dust Seal
Ball Stud Seat
Spring
Spring Seat
Plug
Set Ring
Set Ring
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86828g75

Fig. 88 Exploded view of the steering linkage — 1989-90 Land Cruiser

10. Connect the steering damper to the relay rod, then tighten the nut to 54 ft. lbs. (74 Nm).
11. Connect the damper to the frame bracket, then tighten the nut to 54 ft. lbs. (74 Nm).
12. Attach the tie rod to the knuckle arm, then tighten the nut to 67 ft. lbs. (90 Nm) and install a new cotter pin.
13. Connect the relay rod to the Pitman arm, then tighten the nut to 67 ft. lbs. (90 Nm) and install a new cotter pin.
14. Install the wheels and lower the truck.

1991-96 Land Cruiser

➧ See Figure 89

➨Before working on any of the following steering linkage components, raise the front of the truck and support it with safety stands.

PITMAN ARM

1. Remove the Pitman arm set nut and washer.
2. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the sector shaft.
3. Using a tie rod end puller or similar tool, disconnect the Pitman arm from the relay rod.

To install:

4. To install, align the marks on the Pitman arm and sector shaft and connect them. Tighten the nut to 130 ft. lbs. (177 Nm).
5. Connect the arm to the relay rod, then tighten the nut to 67 ft. lbs. (90 Nm). Install a new cotter pin.

TIE ROD

1. Using a tie rod end puller, disconnect the tie rod from the knuckle arms.
2. Remove the tie rod and remove the tie rod ends.

To install:

3. Screw the tie rod ends onto the tie rod. The tie rod length should be approximately 47.51 in. (121cm). The remaining length of threads on both ends should always be equal.
4. Turn the tie rod ends so they point in the same direction. Tighten the clamp nuts to 27 ft. lbs. (37 Nm).
5. Connect the tie rod to the knuckle arms, then tighten the mounting nuts to 67 ft. lbs. (90 Nm).

RELAY ROD

1. Separate the relay rod from the Pitman arm.
2. Using a tie rod end puller, disconnect the Pitman arm from the relay rod.
3. Disconnect the steering damper from the relay rod.
4. Separate the relay rod from the knuckle arm. Always use a joint separator tool.
5. Remove the rod and inspect it for cracks or other damage.

To install:

6. The relay rod ends are to be replaced, install them and set the length to approximately 42.34 in. (108cm). The amount of threads projecting from each side of the rod must be equal.
7. Set the rod ends so that the end for Pitman arm (with the flange for the steering damper) faces up and the knuckle end points down. Tighten the clamp bolts to 27 ft. lbs. (37 Nm).
8. Install the rod loosely in position at the Pitman arm and knuckle arm.
9. Tighten the Pitman arm nut and the knuckle rod to 67 ft. lbs. (90 Nm). Install a new cotter pin in each fitting.
10. Connect the steering damper to the relay rod, then tighten the nut to 43 ft. lbs. (50 Nm). Install a new cotter pin.

KNUCKLE ARM

1. Disconnect the tie rod at the knuckle arm and remove the arm.
2. Inspect the arm for cracks or other damage.

To install:

3. Install the arm to the steering knuckle and tighten the nut to 71 ft. lbs. (96 Nm).
4. Connect the tie rod to the knuckle arm and tighten the nut to 67 ft. lbs. (90 Nm).

STEERING DAMPER

1. Separate the steering damper at the relay rod.
2. Disconnect the damper at the bracket, then remove the damper with all washers and cushions.

To install:

3. Install the damper to the bracket and tighten the nut to 54 ft. lbs. (74 Nm).
4. Connect the other end of the steering damper to the relay rod. Tighten the nut to 54 ft. lbs. (74 Nm).

Manual Steering Gear

ADJUSTMENTS

Adjustments to the manual steering gear are not necessary during normal service. Adjustments are performed only as part of overhaul.

REMOVAL & INSTALLATION

2WD Pick-Up

1989-95 MODELS

➧ See Figure 90

1. Remove the steering coupling set bolt where it connects to the worm shaft. Make matchmarks on the shaft and flexible coupling.
2. Separate the relay rod from the Pitman arm.
3. Remove the 3 mounting bolts and lift out the steering gear housing.

To install:

4. Position the gear housing so that the worm shaft is lined up in the steering coupling and tighten the mounting bolts to 87 ft. lbs. (118 Nm).
5. Tighten the Pitman arm mounting nut to 90 ft. lbs. (123 Nm).
6. Connect the Pitman arm to the relay rod, then tighten the nut to 67 ft. lbs. (90 Nm).
7. Tighten the coupling set bolt to 26 ft. lbs. (35 Nm).
8. Fill the gear housing with gear oil.

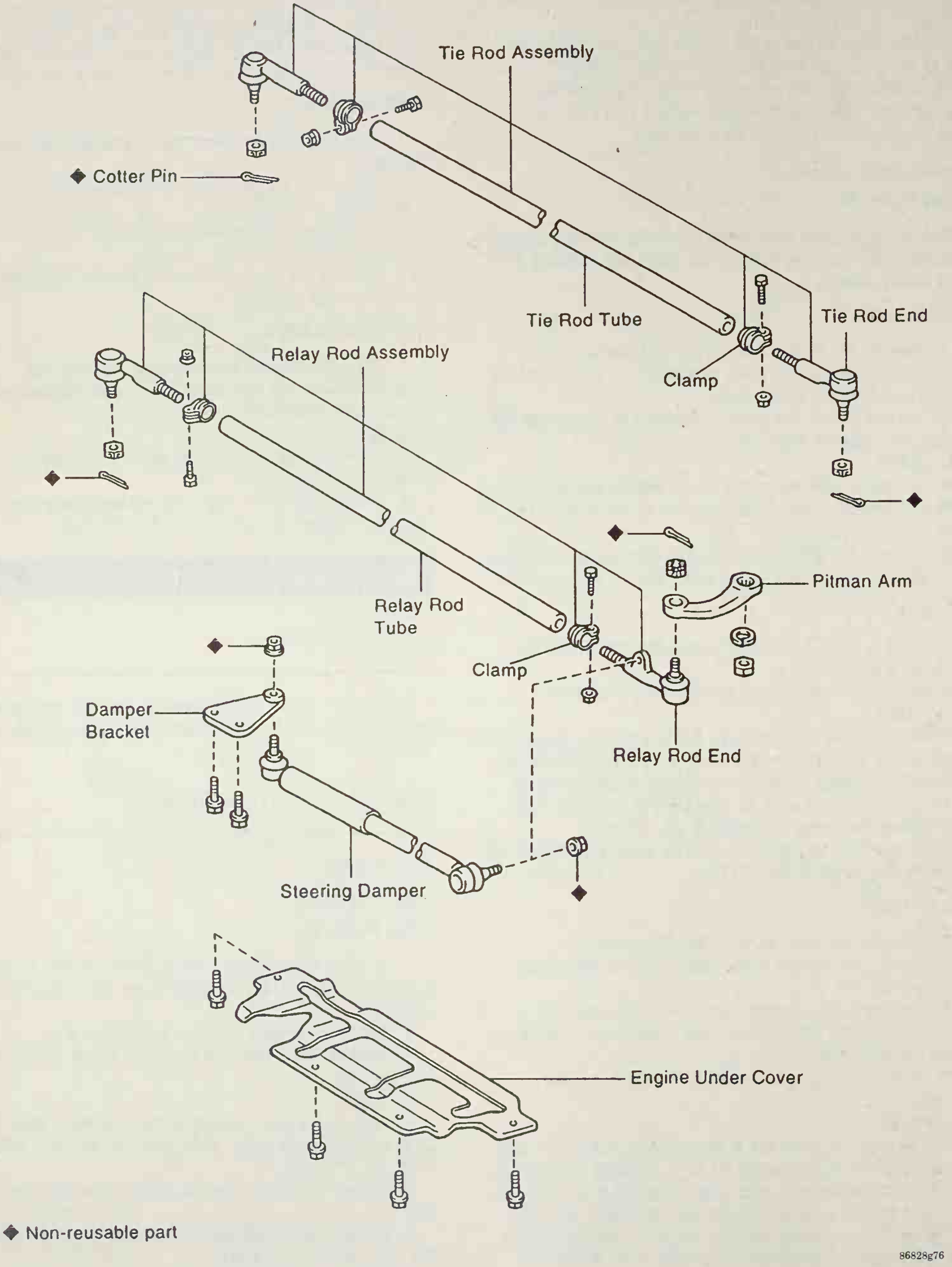

Tie Rod Assembly
◆ Cotter Pin
Tie Rod Tube
Tie Rod End
Relay Rod Assembly
Clamp
Pitman Arm
Relay Rod
Tube
Clamp
Damper
Bracket
Relay Rod End
Steering Damper
Engine Under Cover
◆ Non-reusable part
86828g76

Fig. 89 Exploded view of the steering linkage — 1991-96 Land Cruiser

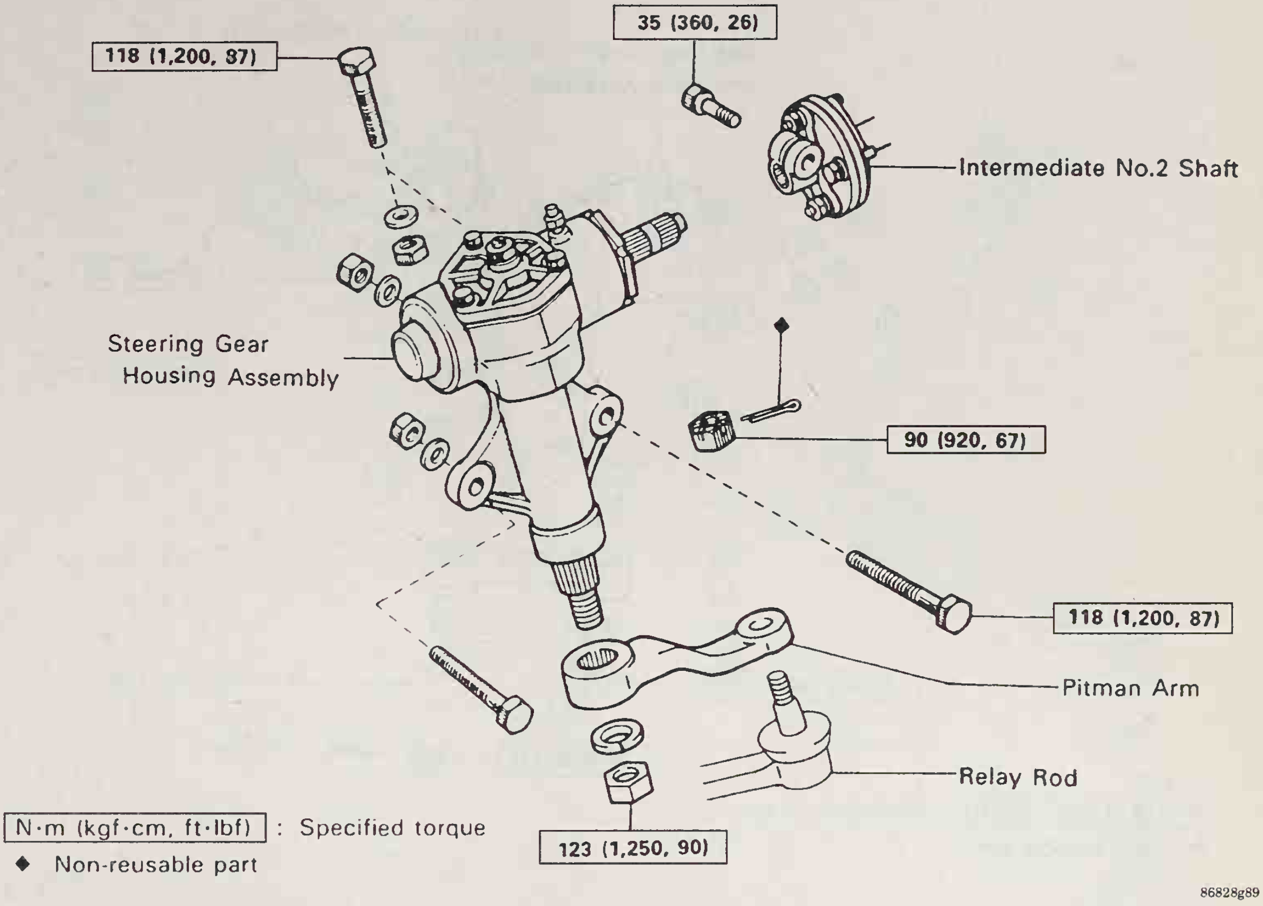

118 (1,200, 87)
35 (360, 26)
Intermediate No.2 Shaft
Steering Gear Housing Assembly
◆
90 (920, 67)
118 (1,200, 87)
Pitman Arm
Relay Rod
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
123 (1,250, 90)
86828g89

Fig. 90 Exploded view of the manual steering gear — 1989-95 2WD Pick-Up

4WD Pick-Up and 4Runner

1989-95 MODELS

➧ See Figure 91

1. Remove the joint protector set bolt.
2. Matchmark the universal joint to the worm shaft and remove the U-joint bolts. Disconnect the U-joint from the worm shaft.
3. Remove the Pitman arm set nut and then disconnect the arm from the gear housing.
4. Remove the 3 housing-to-frame mounting bolts and lift out the gear housing.

To install:

5. Position the housing, then tighten the bolts to 105 ft. lbs. (142 Nm).
6. Connect the U-joint to the worm shaft so that the marks are in alignment, then tighten the bolts to 26 ft. lbs. (35 Nm).
7. Install the joint protector and its bracket set bolt.
8. Connect the Pitman arm, then tighten the nut to 130 ft. lbs. (177 Nm).

Tacoma

➧ See Figure 92

1. Place the wheels facing straight ahead.
2. Remove the steering wheel pad.
3. Remove the steering wheel.
4. Disconnect the right and left hand tie rod ends.
5. Disconnect the intermediate No. 2 shaft.
6. Remove the manual steering gear assembly set bolts, nuts and washers, then lower the assembly from the vehicle.

To install:

7. Attach the manual steering gear assembly into the vehicle. Tighten the set bolts, nuts and washers to 148 ft. lbs. (201 Nm).
8. Attach the intermediate No. 2 shaft.
9. Connect the right and left side tie rod ends.
10. Position the front wheels facing straight ahead. Do it with the front of the vehicle jacked up.
11. Center the spiral cable.

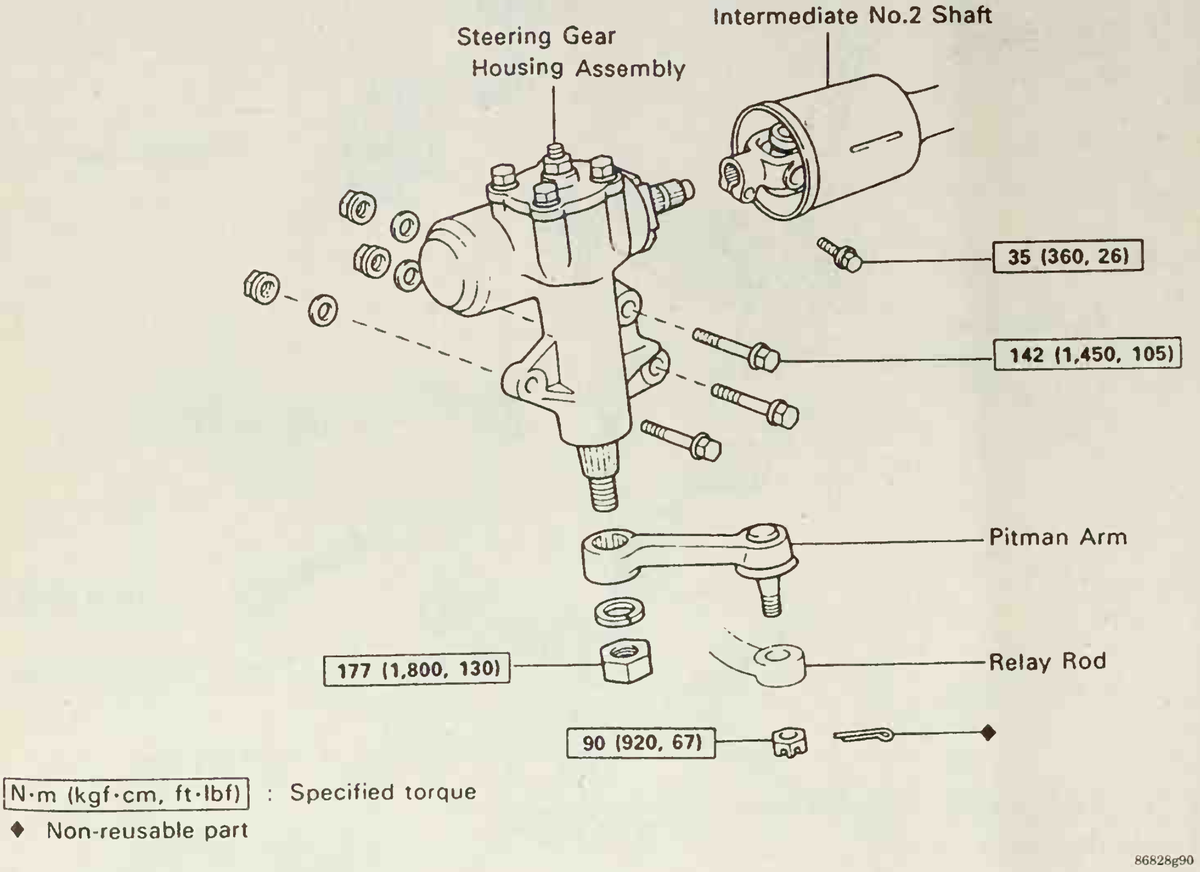

Intermediate No.2 Shaft
Steering Gear Housing Assembly
35 (360, 26)
142 (1,450, 105)
Pitman Arm
177 (1,800, 130)
Relay Rod
90 (920, 67)
◆
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
86828g90

Fig. 91 Exploded view of the manual steering gear — 1989-95 4WD Pick-Up and 4Runner

12. Install the steering wheel. Align the matchmarks on the wheel and steering column mainshaft. Temporarily tighten the wheel set nut, then connect the harness.
13. Check the steering wheel center point.
14. Tighten the steering wheel set nut to 26 ft. lbs. (35 Nm).
15. Check the front end alignment.

Power Steering Gear

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 2WD MODELS

1. Drain the power steering fluid.
2. Disconnect the negative battery cable.
3. Remove the reservoir tank.
4. Remove the air cleaner assembly.
5. Remove the Progressive Power Steering (PPS) solenoid connector.
6. Disconnect the intermediate No. 2 shaft.
7. Remove the bolt and spring washer from the Pitman arm. Using SST 09610-55012 or equivalent, disconnect the Pitman arm from the gear housing.
8. Using SST 09631-22020 or equivalent, disconnect the pressure feed tube and the return tube from the gear housing.
9. Remove the union bolt, gaskets, and the return tube from the gear housing.

To install:

10. Connect the pressure feed tube and tighten it to 26 ft. lbs. (36 Nm).
11. Connect the return tube and tighten it to 30 ft. lbs. (41 Nm).
12. Tighten the union bolt with a new gasket on each side of the return tube to 34 ft. lbs. (47 Nm).
13. Align the alignment marks on the Pitman arm and the cross shaft, and install the spring washer and nut. Tighten the nut to 130 ft. lbs. (177 Nm).

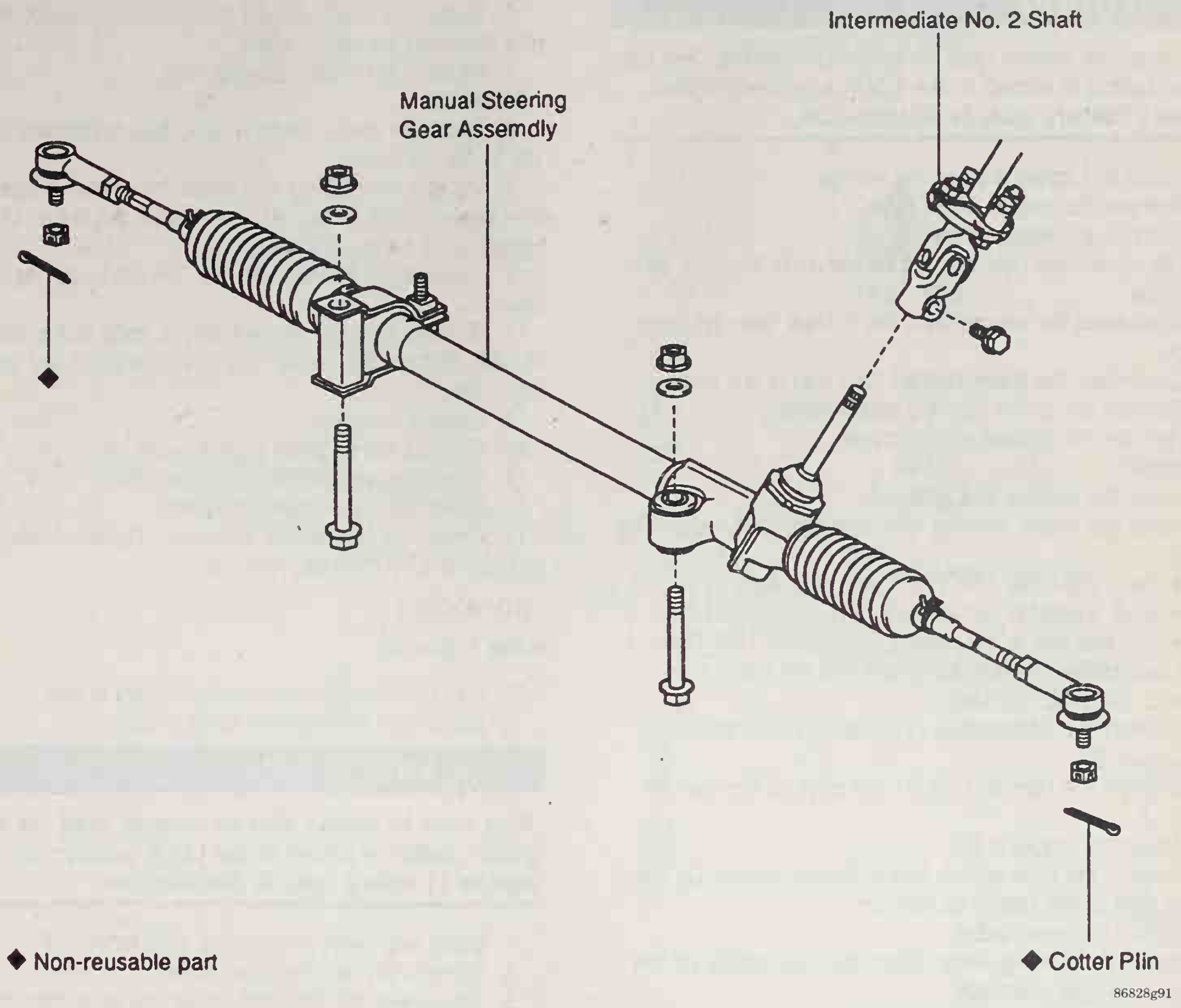


Fig. 92 Exploded view of the manual steering gear — Tacoma

14. Connect the intermediate No. 2 shaft to the steering gear.
15. Install the Progressive Power Steering (PPS) solenoid connector.
16. Install the air cleaner assembly.
17. Install the reservoir tank.
18. Connect the negative battery cable.
19. Refill and bleed the power steering system.

1989-95 4WD MODELS

1. Drain the power steering fluid.
2. Disconnect the negative battery cable.
3. Remove the reservoir tank.
4. Remove the air cleaner assembly.
5. Disconnect the intermediate No. 2 shaft from the steering gear.
6. Remove the set nut from the Pitman arm. Using SST 09628-62011, or equivalent, disconnect the Pitman arm from the gear housing.
7. Using SST 09631-22020, or equivalent, disconnect the pressure feed tube and the return tube from the gear housing.

To install:

8. Connect the pressure feed tube and tighten it to 26 ft. lbs. (36 Nm).
9. Connect the return tube and tighten it to 30 ft. lbs. (41 Nm).
10. Align the alignment marks on the Pitman arm and the cross shaft. Install the spring washer and nut; tighten it to 130 ft. lbs. (177 Nm).
11. Connect the intermediate No. 2 shaft to the steering gear.
12. Install the air cleaner assembly.
13. Install the reservoir tank.
14. Connect the negative battery cable.
15. Refill and bleed the power steering system.

1996 4WD MODELS

1. Place the front wheels facing straight ahead.
2. Disconnect the negative battery cable.
3. Remove the steering wheel pad.

4. Remove the steering wheel.

✲✲CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

5. Raise and safely support the vehicle.
6. Remove the engine under cover.
7. Remove the stabilizer bar.
8. Disconnect the right and left tie rod ends from the steering knuckle.
9. Disconnect the intermediate No. 2 shaft from the steering rack.
10. Disconnect the pressure feed tube and return tube.
11. Remove the power steering rack assembly.
12. Remove the bracket and grommet.

To install:

13. Install the bracket and grommet.
14. Install the power steering rack assembly then tighten the bolts to:
    - Rack assembly bolt: 123 ft. lbs. (167 Nm)
    - Rack assembly nut and bolt: 141 ft. lbs. (191 Nm)
    - Nut and bolt to the bracket: 123 ft. lbs. (167 Nm)
15. Connect the pressure feed tube and the return tube. Tighten to 29 ft. lbs. (40 Nm).
16. Connect the intermediate No. 2 shaft to the steering rack.
17. Connect the right and left tie rod ends to the steering knuckle.
18. Attach the stabilizer bar.
19. Position the front wheels facing straight ahead. Do this with the front of the vehicle jacked up.
20. Center the spiral cable.
21. Install the steering wheel, align the matchmarks on the wheel and column mainshaft.
22. Bleed the power steering system.
23. Check the steering wheel center point.
24. Tighten the steering wheel set nut to 25 ft. lbs. (34 Nm).
25. Install the steering wheel pad.
26. Install the engine under covers.
27. Lower the vehicle.
28. Connect the negative battery cable.
29. Check the front end alignment.

Tacoma

2WD MODELS

➧ See Figure 93

1. Place the front wheels facing straight ahead.
2. Disconnect the negative battery cable.

✲✲CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

3. Raise and safely support the vehicle.
4. Disconnect the right and left tie rod ends from the knuckle.
5. Disconnect the intermediate No. 2 shaft from the steering rack.
6. Using SST 09631-22020 or equivalent, remove the pressure feed and the return tubes.
7. Remove the power steering rack.

To install:

8. Install the power steering rack, then tighten the bolts to 148 ft. lbs. (201 Nm).
9. Install a new O-ring and install the pressure feed tube, then tighten to 33 ft. lbs. (45 Nm). Install the return tube, then tighten to 36 ft. lbs. (49 Nm).
10. Connect the intermediate No. 2 shaft to the steering rack.
11. Connect the right and left tie rod ends to the steering knuckle. Tighten the castle nuts to specification and install new cotter pins.
12. Lower the vehicle.
13. Connect the negative battery cable.
14. Check the steering wheel center point.
15. Bleed the power steering system.
16. Check the front wheel alignment. Tighten the tie rod end locknuts to 67 ft. lbs. (90 Nm)

4WD MODELS

➧ See Figure 94

1. Place the front wheels facing straight ahead.
2. Disconnect the negative battery cable.

✲✲CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

3. Raise and safely support the vehicle.
4. Remove the engine under cover.
5. Disconnect the right and left tie rod ends from the steering knuckle.
6. Disconnect the intermediate No. 2 shaft from the steering rack.
7. Disconnect the pressure feed tube and return tube.
8. Remove the power steering rack assembly.
9. Remove the bracket and grommet.

To install:

10. Install the bracket and grommet.
11. Install the power steering rack assembly then tighten the bolts to:
    - Rack assembly bolt: 123 ft. lbs. (167 Nm)
    - Rack assembly nut and bolt: 141 ft. lbs. (191 Nm)
    - Nut and bolt to the bracket: 123 ft. lbs. (167 Nm)
12. Connect the pressure feed tube and the return tube. Tighten to 29 ft. lbs. (40 Nm).
13. Connect the intermediate No. 2 shaft to the steering rack.
14. Connect the right and left tie rod ends to the steering knuckle.
15. Install the engine under covers.
16. Lower the vehicle.
17. Check the steering wheel center point.
18. Bleed the power steering system.
19. Connect the negative battery cable.
20. Check the front end alignment.

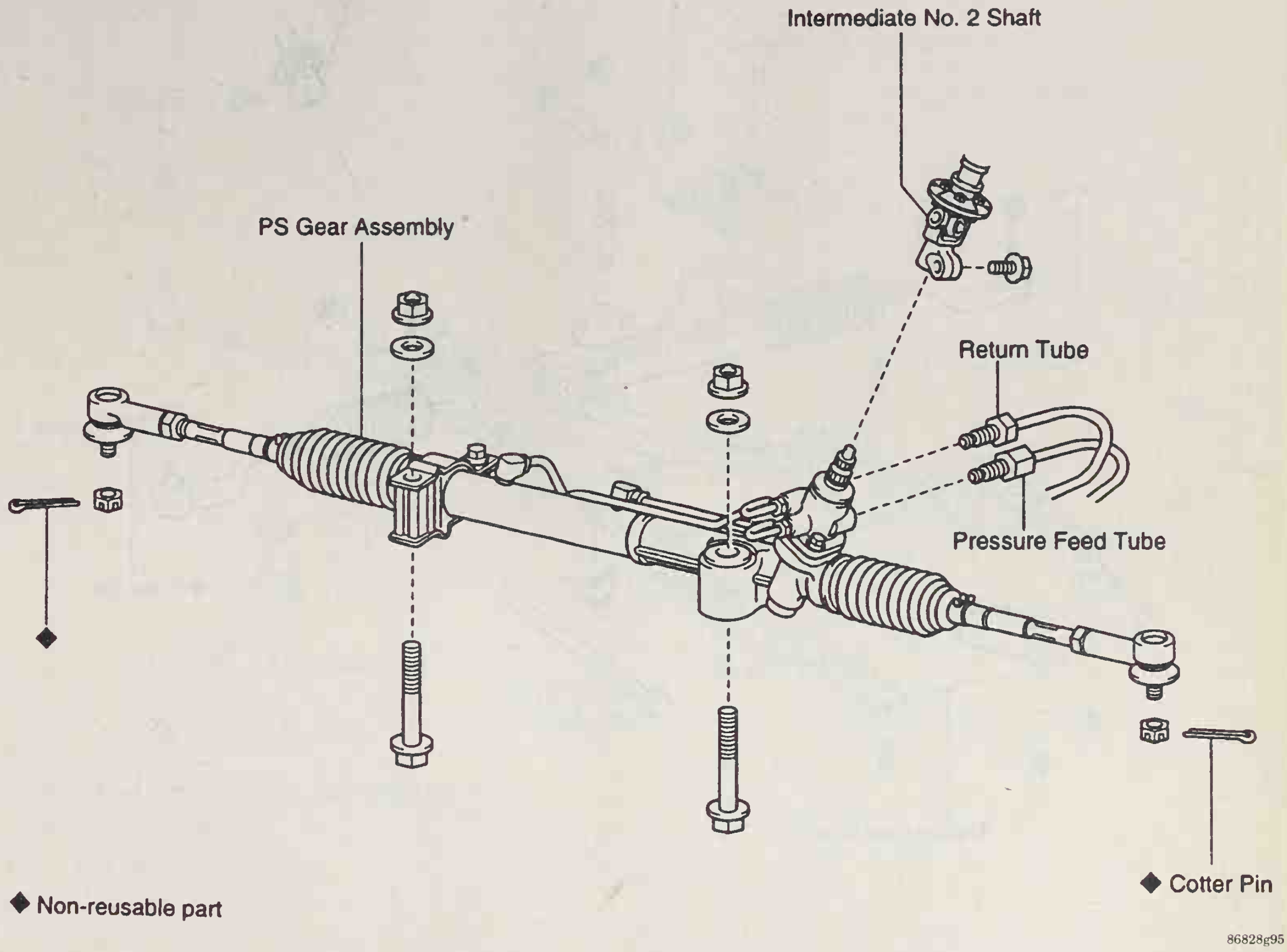


Fig. 93 Exploded view of the power steering gear — Tacoma 2WD

T100

2WD MODELS

➧ See Figure 95

1. Position the front wheels facing straight ahead.
2. Secure the steering wheel so that it does not turn. The driver's seat belt can be used to secure the steering wheel.
3. Place matchmarks on the intermediate shaft and control valve shaft. Remove the lower and upper joint bolts from the intermediate shaft. Disconnect the shaft.
4. Remove the cotter pin and nut from the tie rod ends. Disconnect the tie rod ends using a separator tool.
5. Disconnect the pressure and return pipes using flare nut wrenches.
6. Remove the bracket bolts and grommets.
7. Remove the steering rack assembly from the vehicle.

To install:

8. Install the gear housing then tighten the mounting bolts to 65 ft. lbs. (88 Nm).
9. Install the pressure and return tubes using new O-rings. Tighten the fittings to 15 ft. lbs. (20 Nm).
10. Connect the intermediate shaft. Install the lower and upper joint bolts. Tighten the bolts to 26 ft. lbs. (35 Nm).
11. Connect the tie rod ends, tighten to 67 ft. lbs. (90 Nm) and install a new cotter pin.
12. Connect the negative battery cable.
13. Fill and bleed the steering system.
14. Check and adjust toe-in.

4WD MODELS

➧ See Figure 96

1. Place the front wheels facing straight ahead.
2. Drain the power steering fluid.
3. Disconnect the negative battery cable.

⁂CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

4. Raise and safely support the vehicle.

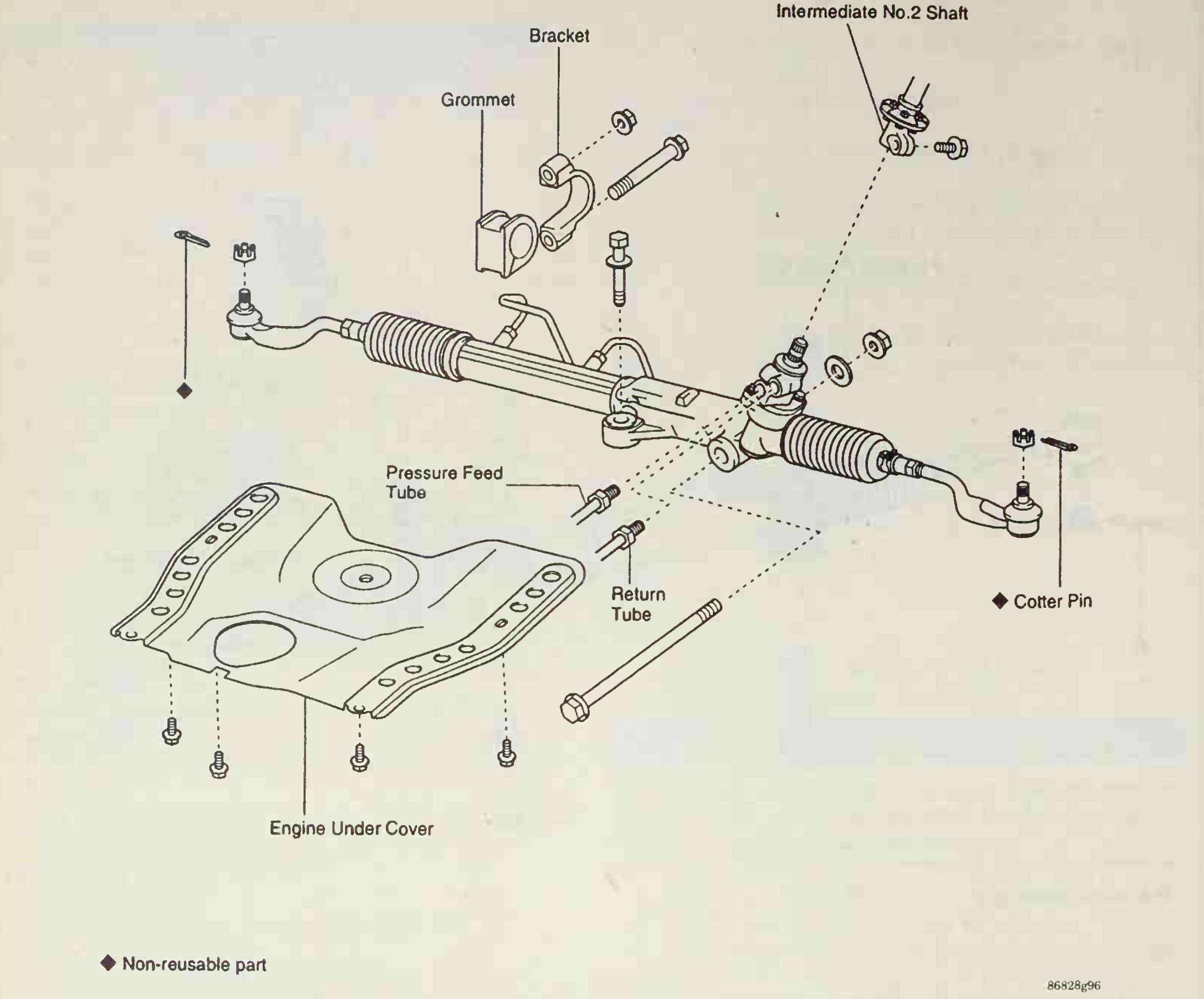


Fig. 94 Exploded view of the power steering gear — Tacoma 4WD

5. Remove the Pitman arm set nut and the spring washer. Using SST 09628-62011, or equivalent, disconnect the Pitman arm from the gear assembly.
6. Disconnect the pressure feed tube and return tube.
7. Make matchmarks and disconnect the intermediate shaft from the steering gear.
8. Remove the power steering gear mounting bolts and remove the gear assembly.

To install:

9. Install the power steering gear assembly, then tighten the bolts to 105 ft. lbs. (142 Nm).
10. Align the matchmarks and connect the intermediate shaft to the steering gear.

➡If installing a new gear assembly, be sure the gear box and the steering wheel are centered.

11. Connect the pressure feed tube and the return tube. Tighten the line fittings to 26 ft. lbs. (36 Nm).
12. Align the alignment marks on the cross shaft and the Pitman arm and connect the Pitman arm. Install the spring washer and the Pitman arm set nut, then tighten to 130 ft. lbs. (177 Nm).
13. Lower the vehicle.
14. Check the steering wheel center point.
15. Fill and bleed the power steering system.
16. Connect the negative battery cable.

Land Cruiser

1. Drain the power steering fluid.
2. Disconnect the negative battery cable.

⁂CAUTION

Work must be started after 90 seconds from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected.

3. Raise and safely support the vehicle.
4. Remove the frame seal.
5. Remove the link joint protector.

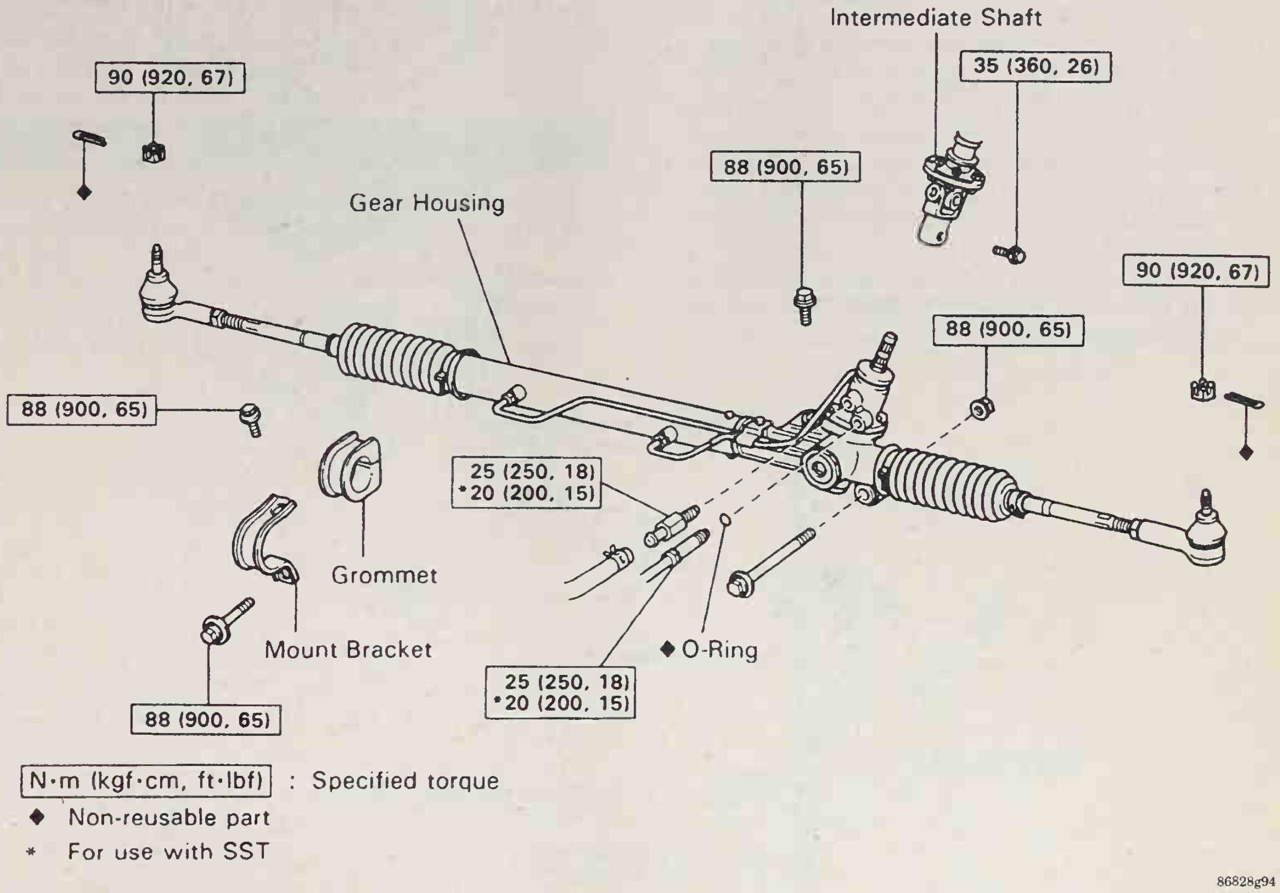

Intermediate Shaft
90 (920, 67)
35 (360, 26)
88 (900, 65)
Gear Housing
90 (920, 67)
88 (900, 65)
88 (900, 65)
25 (250, 18)
*20 (200, 15)
Grommet
Mount Bracket
◆ O-Ring
25 (250, 18)
*20 (200, 15)
88 (900, 65)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
* For use with SST
86828g94

Fig. 95 Exploded view of the power steering gear — T100 2WD

6. Remove the Pitman arm set nut and spring washer. Using SST 09628-62011, or equivalent, disconnect the Pitman arm from the gear assembly.

7. Using SST 09631-22020, or equivalent, disconnect the pressure feed and the return tubes.

8. Separate the sliding yoke sub-assembly from the steering gear.

9. Remove the mounting bolts and the power steering gear assembly.

To install:

10. Install the power steering gear assembly, then tighten the bolts to 105 ft. lbs. (142 Nm).

11. Connect the sliding yoke sub-assembly to the steering gear.

12. Connect the pressure feed and the return tubes. Tighten the tube fittings to 26 ft. lbs. (36 Nm).

13. Connect the Pitman arm and align the alignment marks on the cross shaft and the Pitman arm. Install the spring washer and the Pitman arm set nut. Tighten the nut to 130 ft. lbs. (177 Nm).

14. Refill and bleed the power steering system.

15. Install the link joint protector.

16. Install the frame seal.

17. Lower the vehicle.

18. Connect the negative battery cable.

19. Test drive the vehicle. Check the steering wheel center point.

Power Steering Pump

REMOVAL & INSTALLATION

1. On some models it will be necessary to remove the air cleaner.

2. Disconnect the high tension lines at the distributor, then disconnect the air lines at the air valve.

3. With a suitable device, suck some fluid out of the reservoir tank.

4. Disconnect the return hose at the power steering pump.

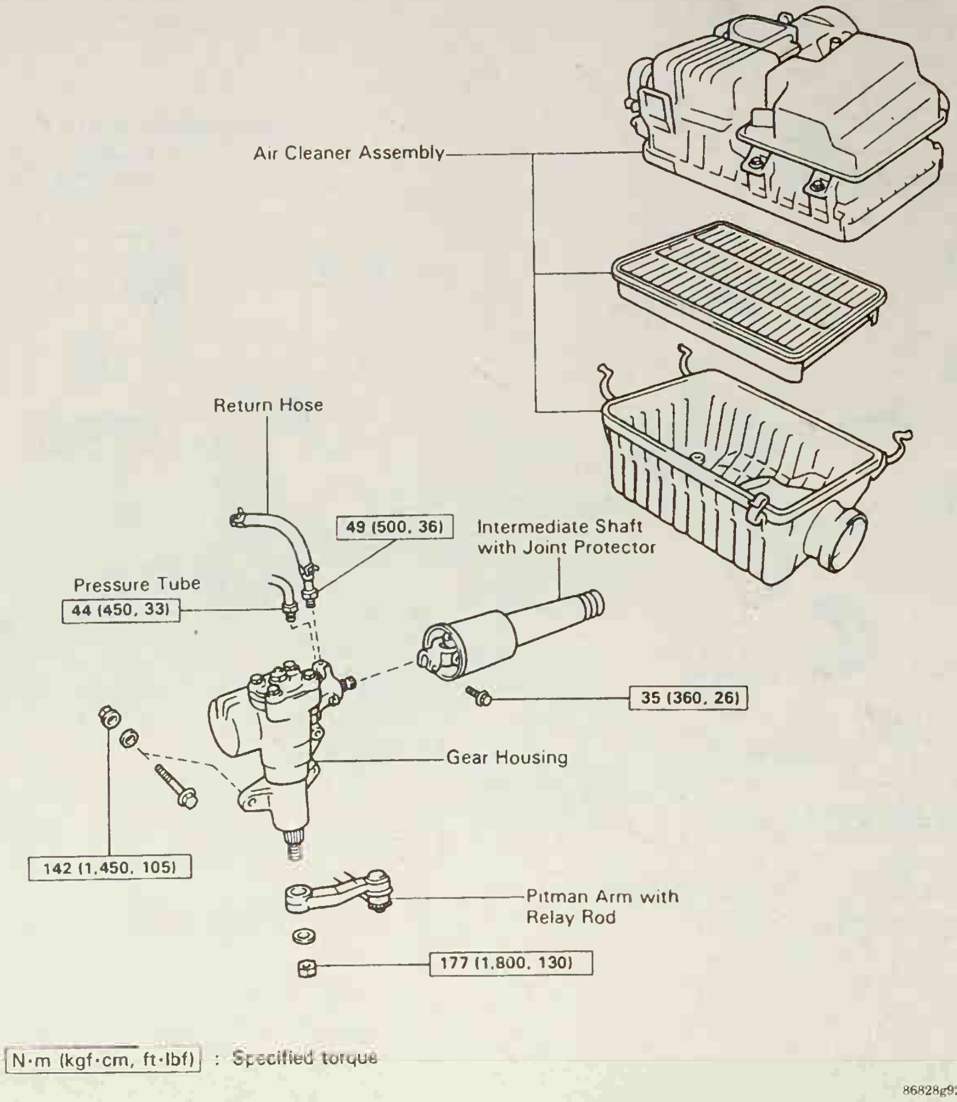

Air Cleaner Assembly
Return Hose
49 (500, 36)
Intermediate Shaft with Joint Protector
Pressure Tube
44 (450, 33)
35 (360, 26)
Gear Housing
142 (1,450, 105)
Pitman Arm with Relay Rod
177 (1,800, 130)
N·m (kgf·cm, ft·lbf) : Specified torque
86828g92

Fig. 96 Exploded view of the power steering gear — T100 4WD

5. Separate the pressure line at the pump. Some models have a union bolt with gaskets. Discard the old gaskets.
6. Loosen the drive belt pulley retaining nut. Loosen the idler pulley and adjusting bolt and remove the drive belt.
7. Remove the drive pulley and Woodruff key.
8. Remove the power steering pump. Some models have an O-ring, discard the old O-ring.

To install:

9. On the O-ring type, coat the O-ring with power steering fluid, then install it to the pump assembly.
10. Install the pump in its bracket, then tighten the nuts to 27-29 ft. lbs. (36-39 Nm).
11. Install the drive pulley and belt. Tighten the pulley bolt to 32 ft. lbs. (43 Nm) and check the drive belt tension.
12. Attach the pressure line to the pump; tighten the flare nut to 33 ft. lbs. (45 Nm), and the union bolt with new gaskets to 42 ft. lbs. (56 Nm).
13. Connect the return hose.
14. Connect the air hoses and the high tension leads.
15. If removed, install the air cleaner.
16. Fill the reservoir with fluid, bleed the system and check for leaks.

BLEEDING

WARNING

Vehicles equipped with Rear Wheel Anti-Lock (RWAL) brakes use a different bleeding procedure than those not so equipped. Bleeding the RWAL system requires the use of an electronic brake tester, an expensive unit usually found only at dealers.

Without RWAL System

1. Check the fluid level in the reservoir. It should be at the correct level (HOT or COLD) depending on engine temperature.
2. Start the engine and run it below 1000 rpm.
3. Turn the steering wheel from lock-to-lock 3 or 4 times.

4. Shut the engine **OFF**. Connect a clear plastic tube to the bleeder port on the steering gearbox. Place the other end of the tube in a container of power steering fluid. Make sure the end is immersed in the fluid.

5. Start the engine again. Turn the wheel lock-to-lock 3-4 times and return the steering wheel to the centered position.

6. Loosen the bleeder plug. Observe the tubing; when no air bubbles are seen, close the bleeder plug.

⁂CAUTION

Do not allow the tubing to come off the bleed port. The power steering fluid is under high pressure and may be very hot.

7. Inspect the fluid level with the engine running; the fluid should not be foamy or cloudy. Shut the engine **OFF** and check the fluid level. If level rises too much, try re-bleeding the system. If the problem persists, repair the power steering system.

With RWAL System

The RWAL system uses power steering fluid pressure to maintain control pressures in the brake system. While the fluids never mix, air in the power steering system can render the rear anti-lock brakes ineffective.

If the any of the lines or components in the power steering system are loosened or removed, the brake system must be bled as well. Preliminary bleeding of both the power steering and brake systems will eliminate most of the air, but the vehicle MUST be taken to a dealer to have the systems properly bled using the Toyota ABS Checker. Be warned that until this is done, the rear wheel anti-lock brake function may be impaired.

WHEEL ALIGNMENT

			Caster		Camber			Steering
Year	Model	Model Type	Range (deg.)	Preferred Setting (deg.)	Range (deg.)	Preferred Setting (deg.)	Toe-in (in.)	Axis Inclination (deg.)
1989	Pick-up 2WD	① ⑨	0.19P-1.19P	0.69P	0.06N-0.94P	0.44P	0.05N-0.08N	10.00
	Pick-up 2WD	① ②	0.25P-1.25P	0.75P	0-1P	0.50P	0.03N-0.09N	10.00
	Pick-up 2WD	① ⑩	0.50P-1.50P	1P	0.06N-0.94P	0.44P	0.02N-0.13N	10.03
	Pick-up 2WD	① ⑬	0.63P-1.63P	1.13P	0.13N-0.88P	0.38P	0.13N-0.19N	10.13
	Pick-up 2WD	① ⑭	0.25P-1.25P	0.75P	0-1P	0.50P	0.03N-0.09N	10.00
	Pick-up 2WD	① ⑧	0.50P-1.50P	1P	0.06N-0.94P	0.44P	0.06N-0.13N	10.03
	Pick-up 2WD	① ⑪	0.69P-1.69P	1.19P	0.13N-0.88P	0.38P	0.13N-0.19N	10.13
	Pick-up 2WD	① ⑭	0.69P-1.69P	1.19P	0.13N-0.88P	0.38P	0.13N-0.19N	10.13
	Pick-up 2WD	① ⑮	0.88P-1.88P	1.38P	0.31N-0.69P	0.19P	0.22N-0.28N	10.31
	Pick-up 2WD	① ⑰	0.63P-1.63P	1.13P	0.06N-0.94P	0.44P	0.06N-0.13N	10.00
	Pick-up 2WD	① ⑱	0.06P-1.06P	0.56P	0.06P-1.06P	0.56P	0.19N-0.25N	9.91
	Pick-up 2WD	① ㉑	0.44N-0.56P	0.06P	0.06P-1.06P	0.56P	0.17N-0.23N	9.94
	Pick-up 2WD	① ㉕	0.81P-1.81P	1.31P	0.13N-0.88P	0.38P	0.09N-0.16N	10.09
	Pick-up 2WD	① ㉖	0.94P-1.94P	1.44P	0.19N-0.81P	0.31P	0.16N-0.22N	10.19
	Pick-up 2WD	① ㉛	0.38N-0.63P	0.13P	0.06P-1.06P	0.56P	0.16N-0.22N	9.94
	Pick-up 4WD		2P-3P	2.50P	0.25P-1.25P	0.75P	0-0.06N	11.81
	4-Runner		1.63P-2.63P	2.13P	0.13P-1.13P	0.63P	0.08N-0.16N	11.94
	Land Cruiser		0.06P-1.56P	0.81P	0.25P-1.75P	1P	0.05N-0.14N	9.50
1990	Pick-up 2WD	⑨ ㉞	0.06N-0.94P	0.44P	0-1P	0.50P	0.03N-0.09N	10.00
	Pick-up 2WD	③ ㉞	0.13P-1.13P	0.63P	0-1P	0.50P	0.03N-0.09N	10.00
	Pick-up 2WD	⑩ ㉞	0.19P-1.19P	0.69P	0-1P	0.50P	0.02N-0.08N	10.00
	Pick-up 2WD	⑩ ㉞	0.44P-1.44P	0.94P	0.06N-0.94P	0.44P	0.06N-0.13N	10.00
	Pick-up 2WD	⑧ ㉞	0.75P-1.75P	1.25P	0.13N-0.88P	0.38P	0.09N-0.16N	10.09
	Pick-up 2WD	⑨ ㉞	0.19P-1.19P	0.69P	0-1P	0.50P	0.03N-0.09N	10.00
	Pick-up 2WD	④ ㉞	0.19P-1.19P	0.69P	0-1P	0.50P	0.02N-0.08N	10.00
	Pick-up 2WD	㉝ ㉞	0.44P-1.44P	0.94P	0.06N-0.94P	0.44P	0.06N-0.13P	10.00
	Pick-up 2WD	⑪ ㉞	0.63P-1.63P	1.13P	0.88N-0.88P	0.38P	0.25N-0.38N	10.13
	Pick-up 2WD	⑬ ㉞	0.75P-1.75P	1.25P	0.88N-0.88P	0.38P	0.09N-0.16N	10.09
	Pick-up 2WD	⑱ ㉞	0.88P-1.88P	1.38P	0.31N-0.69P	0.19P	0.19N-0.25N	10.25
	Pick-up 2WD	⑰ ㉞	0.38P-1.38P	0.88P	0.06N-0.94P	0.44P	0.06N-0.13P	10.00
	Pick-up 2WD	⑱ ㉞	0.06P-1.06P	0.56P	0-1P	0.50P	0.16N-0.22N	10.00
	Pick-up 2WD	㉛ ㉞	0.44N-0.56P	0.06P	0-1P	0.50P	0.16N-0.22N	10.00
	Pick-up 2WD	㉒ ㉞	0.75P-1.75P	1.25P	0-1P	0.50P	0.19N-0.25N	10.00
	Pick-up 2WD	⑲ ㉞	0.69P-1.69P	1.19P	0.06N-0.94P	0.44P	0.09N-0.16N	10.06
	Pick-up 2WD	㉖ ㉞	0.69P-1.69P	1.19P	0.06N-0.94P	0.44P	0.06N-0.13N	10.06
	Pick-up 2WD	㉕ ㉞	0.50N-0.50P	0	0-1P	0.50P	0.19N-0.25N	10.00
	Pick-up 4WD		2P-3P	2.50P	0.25P-1.25P	0.75P	0-0.06N	11.81
	4-Runner		2P-3P	2.50P	0.25P-1.25P	0.75P	0.03N-0.09N	11.81
	Land Cruiser		0.06P-1.56P	0.81P	0.25P-1.75P	1P	0.05N-0.14N	9.50
1991	Pick-up 2WD	① ④	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.03N-0.16N	10.00
	Pick-up 2WD	① ③	0.06N-1.44P	0.69P	0.31N-1.19P	0.44P	0.03N-0.16N	10.00
	Pick-up 2WD	① ④	0.22P-1.72P	0.97P	0.31N-1.19P	0.44P	0-0.19N	10.03
	Pick-up 2WD	① ⑭	0.50P-2.00P	1.25P	0.38N-1.13P	0.38P	0.03N-0.22N	10.09
	Pick-up 2WD	① ⑲	0.19N-1.31P	0.56P	0.25N-1.25P	0.50P	0.13N-0.31N	10.00
	Pick-up 2WD	① ⑳	0.19N-1.31P	0.56P	0.25N-1.25P	0.50P	0.09N-0.28N	10.00
	Pick-up 2WD	① ㉒	1.00P-2.50P	1.75P	0.25N-1.25P	0.50P	0.09N-0.28N	10.00

86828c01

WHEEL ALIGNMENT

Year	Model	Model Type	Caster Range (deg.)	Caster Preferred Setting (deg.)	Camber Range (deg.)	Camber Preferred Setting (deg.)	Toe-in (in.)	Steering Axis Inclination (deg.)
1991	Pick-up 2WD	① ㉕	0.44P-1.31P	1.19P	0.38N-1.13P	0.38P	0.03N-0.22N	10.09
	Pick-up 2WD	① ㉖	0.44P-1.31P	1.19P	0.31N-1.19P	0.44P	0.03N-0.22N	10.06
	Pick-up 2WD	① ㉛	1.00P-2.50P	1.75P	0.25N-1.25P	0.50P	0.13N-0.31N	10.00
	Pick-up 4WD		2P-3P	2.50P	0.25P-1.25P	0.75P	0-0.06N	11.81
	4-Runner		2P-3P	2.50P	0.25P-1.25P	0.75P	0.03N-0.09N	11.81
	Land Cruiser	㉟	0.69P-2.69P	1.69P	0.25P-1.75P	1P	0-0.19N	13.00
	Land Cruiser	㊱	2P-4P	3P	0.25P-1.75P	1P	0-0.19N	13.00
1992	Pick-up 2WD	① ④	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.03N-0.16N	10.00
	Pick-up 2WD	① ③	0.06N-1.44P	0.69P	0.31N-1.19P	0.44P	0.03N-0.16N	10.00
	Pick-up 2WD	① ⑧	0.22P-172P	0.97P	0.31N-1.19P	0.44P	0-0.19N	10.03
	Pick-up 2WD	① ⑭	0.50P-2.00P	1.25P	0.38N-1.13P	0.38P	0.03N-0.22N	10.03
	Pick-up 2WD	① ⑲	0.19N-1.31P	0.56P	0.25N-1.25P	0.50P	0.13N-0.31N	10.00
	Pick-up 2WD	① ⑳	0.19N-1.31P	0.56P	0.25N-1.25P	0.50P	0.09N-0.28N	10.00
	Pick-up 2WD	① ㉒	1.00P-2.50P	1.75P	0.25N-1.25P	0.50P	0.09N-0.28N	10.00
	Pick-up 2WD	① ㉕	0.44P-1.94P	1.19P	0.38N-1.13P	0.38P	0.03N-0.22N	10.09
	Pick-up 2WD	① ㉖	0.44P-1.94P	1.19P	0.31N-1.19P	0.44P	0.03N-0.22N	10.06
	Pick-up 2WD	① ㉛	1.00P-2.50P	1.75P	0.25P-1.25P	0.50P	0.13N-0.31N	10.00
	Pick-up 4WD		2P-3P	2.50P	0.25P-1.25P	0.75P	0-0.06N	11.81
	4Runner		2P-3P	2.50P	0.25P-1.25P	0.75P	0.03N-0.09N	11.81
	Land Cruiser	㉟	0.69P-2.69P	1.69P	0.25P-1.75P	1P	0-0.19N	13.00
	Land Cruiser	㊱	2P-4P	3P	0.25P-1.75P	1P	0-0.19N	13.00
1993	Pick-up 2WD	⑤	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.03N-0.13P	9.25
	Pick-up 2WD	⑥	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.02N-0.14P	9.25
	Pick-up 2WD	⑫	0.25P-1.75P	1.00P	0.25N-1.25P	0.50P	0-0.16P	9.25
	Pick-up 2WD	㉚	0.50P-2.00P	1.25P	0.25N-1.25P	0.33P	0.05N-0.20P	9.25
	Pick-up 2WD	㉒	0.25N-1.25P	0.50P	0.25N-1.25P	0.50P	0.14N-0.30P	9.25
	Pick-up 2WD	㉔	1.00P-2.25P	1.75P	0.25N-1.25P	0.50P	0.14N-0.30P	9.25
	Pick-up 2WD	㉗	0.50P-2.00P	1.25P	0.25N-1.25P	0.33P	0.05N-0.20P	9.25
	Pick-up 2WD	㉜	1.00P-2.50P	1.75P	0.25N-1.25P	0.50P	0.014N-0.30P	9.25
	Pick-up 4WD		1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.012P	11.00
	4-Runner		1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.012P	11.00
	Land Cruiser		2.00P-4.00P	3.00P	0.25P-1.75P	1.00P	0-0.16P	12.25
	T100 2WD	㊲	1.75P-3.25P	2.50P	0.25N-1.25P	0.50P	0.04N-0.20P	9.25
	T100 2WD	㊳	2.25P-3.75P	3.00P	0-1.50P	0.50P	0.27N-0.43P	8.75
	T100 4WD		0.75P-2.25P	1.50P	0-1.50P	0.75P	0.04N-0.20P	11.00
1994	Pick-up 2WD	⑦	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.03N-0.13P	9.25
	Pick-up 2WD	㉘	0.50P-2.00P	1.25P	0.25N-1.25P	0.33P	0.05N-0.20P	9.25
	Pick-up 4WD		1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.12P	11.00
	4-Runner		1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.12P	11.00
	Land Cruiser		2.00P-4.00P	3.00P	0.25P-1.75P	1.00P	0-0.16P	12.25
	T100 2WD	㊲	1.75P-3.25P	2.50P	0.25N-1.25P	0.50P	0.04N-0.20P	9.75
	T100 2WD	㊳	2.25P-3.75P	3.00P	0-1.50P	0.50P	0.27N-0.43P	8.75
	T100 4WD		0.75P-2.25P	1.50P	0-1.50P	0.75P	0.04N-0.20P	11.00
1995	Pick-up 2WD	⑦	0-1.50P	0.75P	0.25N-1.25P	0.50P	0.03N-0.13P	9.25
	Pick-up 2WD	㉙	0.50P-2P	1.25P	0.25N-1.25P	0.33P	0.05N-0.20P	9.25
	Pick-up 4WD	㊶	1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.12P	11.00

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WHEEL ALIGNMENT

Year	Model	Model Type	Caster		Camber		Toe-in (in.)	Steering Axis Inclination (deg.)
			Range (deg.)	Preferred Setting (deg.)	Range (deg.)	Preferred Setting (deg.)		
1995	4Runner		1.75P-3.25P	2.50P	0-1.50P	0.75P	0.04N-0.12P	11.00
	Land Cruiser		2P-4P	3P	0.25P-1.75P	1P	0-0.16P	12.25
	Tacoma 2WD	㊶	1.33P-2.13P	1.83P	0.50N-0.50P	0	0.04N-0.04P	10.00
	Tacoma 4WD	㊶	2.33P-3.33P	2.83P	0.50N-0.50P	0	0.08N-0.08P	10.75
	T100 2WD	㊲	1.75P-3.25P	2.50P	0.25N-1.25P	0.50P	0.04N-0.20P	9.75
	T100 2WD	㊳	2.25P-3.75P	3P	0-1.50P	0.50P	0.27N-0.43P	8.75
	T100 4WD		0.75P-2.25P	1.50P	0-1.50P	0.75P	0.04N-0.20P	11.00
1996	4Runner	㊴	2.67P-4.17P	3.37P	0.97N-0.54P	0.22N	0.03N-0.31P	10.97
	4Runner	㊵	1.88P-3.38P	2.63P	0.58N-0.92P	0.17P	0-0.40P	10.58
	Land Cruiser		2P-4P	3P	0.25P-1.75P	1P	0.08P-0.24P	13.00
	Tacoma 2WD	㊶	1.08P-2.67P	1.83P	0.75N-0.75P	0	0.08N-0.08P	10.00
	Tacoma 4WD	㊶	2.08P-3.58P	2.83P	0.75N-0.75P	0	0.08N-0.08P	10.75
	T100 2WD	㊲	1.75P-3.25P	2.50P	0.33N-1.17P	0.42P	0.04N-0.20P	12.08
	T100 2WD	㊳	0.83N-2.33P	1.58P	0.33N-1.17P	0.42P	0.20P-0.36P	12.08
	T100 4WD		0.75P-2.25P	1.50P	0-1.50P	0.75P	0.04N-0.20P	12.00

1 NOTE: Front end alignment specifications are given according to the Vehicle Identification Number. Before using this information, verify that the VIN is correct for the alignment data used
2 RN80L-TRLD, RN80L-TRMR
3 RN80L-TRMR
4 RN80L-TRMD, RN80L-TRSD
5 RN80L-TRSDEA, RN80L-TRSDEK, RN80L-TRMDEA, RN80L-TRMDEK
6 RN80L-TRMREA, RN80L-TRMREK
7 RN80L-TRSDEA, RN80L-TRMDEA, RN80L-TRMREA, RN80L-TRMREK
8 RN85L-TRMD, RN85L-TRSD
9 RN80L-TRKR, RN80L-TRTR
10 RN85L-TRLD, RN85L-TRMD
11 RN85L-TRMS, RN85L-TRSS
12 RN85L-TRMDEA, RN85L-TRMDEK, RN85L-TRSDEA, RN85L-TRSDEK
13 RN90L-CRLD, RN90L-CRMD
14 RN90L-CRMD, RN90L-CRDS
15 RN90L-CRMS, RN90L-CRSS
17 VZ85L-TRMD, VZ85L-TRSD
18 VZ85L-THMD, VZ85L-THSD
19 VZN85L-THMD
20 VZN85L-THSD
21 VZN85L-TRMR, VZN85L-TRSR
22 VZN85L-TWMR, VZN85L-TWSR
24 VZN85L-TWMREA6, VZN85L-TWSREA6
25 VZN90L-CRMD, VZ90L-CRSD
26 VZN90L-CRMG, VZN90L-CRPG
27 VZN90L-CRMDEA, VZN90L-CRMDEK, VZN90L-CRSDEA, VZN90L-CRSDEK VZN90L-CRMGEA, VZN90L-CRPGEA
28 RN90L-CRSDEA, RN90L-CRMDEA, RN90L-CRSDEK, RN90L-CRMDEK, VZN90L-CRMDEA, VZN90L-CRMDEK, VZN90L-CRSDEA, VZN90L-CRSDEK, VZ90L-TMWREA6, VZN95L-TWSREA6, VZN95L-TWSEK6
29 RN90L-CRSDEA, RN90L-CRMDEA, RN90L-CRSDEK, RN90L-CRMDEK, VZN90L-CRMDEA, VZN90L-CRMDEK, VZN90L-CRSDEA, VZN90L-CRSDEK VZN90L-CRMGEA, VZN90L-CRPGEA (unloaded)
30 RN90L-CRSDEA, RN90L-CRSDEK, RN90L-CRMDEA, RN90L-CRMDEK
31 VZN95L-TWMR, VZN95L-TWSR
32 VZN95L-TWMREA6, VZN95L-TWSREA6, VZN95L-TWSREK6
33 RN90L-CRLDL
34 Manual steering gear: 1P
Power steering gear: 2.50P
35 With 10.5R tire
36 Without 10.5R tire
37 1/2 ton
38 1 ton
39 Tire size 225/75R15
40 Tire size 265/70R16
41 Loaded vehicle

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9

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BRAKE OPERATING SYSTEMS

Basic Operating Principles

Hydraulic systems are used to actuate the brakes of automobiles. The system transports the power required to force the frictional surfaces of the braking system together from the pedal to the individual brake units at each wheel. A hydraulic system is used for two reasons.

First, fluid under pressure can be carried to all parts of an automobile by small pipes and flexible hoses without taking up a significant amount of room or posing routing problems.

Second, a great mechanical advantage can be given to the brake pedal end of the system, and the foot pressure required to actuate the brakes can be reduced by making the surface area of the master cylinder pistons smaller than that of any of the pistons in the wheel cylinders or calipers.

The master cylinder consists of a fluid reservoir and a double cylinder and piston assembly. Double type master cylinders are designed to separate the front and rear braking systems hydraulically in case of a leak.

Steel lines carry the brake fluid to a point on the vehicles frame near each of the vehicles wheels. The fluid is then carried to the calipers and wheel cylinders by flexible tubes in order to allow for suspension and steering movements.

In drum brake systems, each wheel cylinder contains two pistons, one at either end, which push outward in opposite directions.

In disc brake systems, the cylinders are part of the calipers. One cylinder in each caliper is used to force the brake pads against the disc.

All pistons employ some type of seal, usually made of rubber, to minimize fluid leakage. A rubber dust boot seals the outer end of the cylinder against dust and dirt. The boot fits around the outer end of the piston on disc brake calipers, and around the brake actuating rod on wheel cylinders.

The hydraulic system operates as follows: When at rest, the entire system, from the piston(s) in the master cylinder to those in the wheel cylinders or calipers, is full of brake fluid. Upon application of the brake pedal, fluid trapped in front of the master cylinder piston(s) is forced through the lines to the wheel cylinders. Here, it forces the pistons outward, in the case of drum brakes, and inward toward the disc, in the case of disc brakes. The motion of the pistons is opposed by return springs mounted outside the cylinders in drum brakes, and by spring seals, in disc brakes.

Upon release of the brake pedal, a spring located inside the master cylinder immediately returns the master cylinder pistons to the normal position. The pistons contain check valves and the master cylinder has compensating ports drilled in it. These are uncovered as the pistons reach their normal position. The piston check valves allow fluid to flow toward the wheel cylinders or calipers as the pistons withdraw. Then, as the return springs force the brake pads or shoes into the released position, the excess fluid reservoir through the compensating ports. It is during the time the pedal is in the released position that any fluid that has leaked out of the system will be replaced through the compensating ports.

Dual circuit master cylinders employ two pistons, located one behind the other, in the same cylinder. The primary piston is actuated directly by mechanical linkage from the brake pedal through the power booster. The secondary piston is actuated by fluid trapped between the two pistons. If a leak develops in front of the secondary piston, it moves forward until it bottoms against the front of the master cylinder, and the fluid trapped between the pistons will operate the rear brakes. If the rear brakes develop a leak, the primary piston will move forward until direct contact with the secondary piston takes place, and it will force the secondary piston to actuate the front brakes. In either case, the brake pedal moves farther when the brakes are applied, and less braking power is available.

All dual circuit systems use a switch to warn the driver when only half of the brake system is operational. This switch is located in a valve body which is mounted on the firewall or the frame below the master cylinder. A hydraulic piston receives pressure from both circuits, each circuit's pressure being applied to one end of the piston. When the pressures are in balance, the piston remains stationary. When one circuit has a leak, however, the greater pressure in that circuit during application of the brakes will push the piston to one side, closing the switch and activating the brake warning light.

In disc brake systems, this valve body also contains a metering valve and, in some cases, a proportioning valve. The metering valve keeps pressure from traveling to the disc brakes on the front wheels until the brake shoes on the rear wheels have contacted the drums, ensuring that the front brakes will never be used alone. The proportioning valve controls the pressure to the rear brakes to lessen the chance of rear wheel lock-up during very hard braking.

Warning lights may be tested by depressing the brake pedal and holding it while opening one of the wheel cylinder bleeder screws. If this does not cause the light to go on, substitute a new lamp, make continuity checks, and, finally, replace the switch as necessary.

The hydraulic system may be checked for leaks by applying pressure to the pedal gradually and steadily. If the pedal sinks very slowly to the floor, the system has a leak. This is not to be confused with a springy or spongy feel due to the compression of air within the lines. If the system leaks, there will be a gradual change in the position of the pedal with a constant pressure.

Check for leaks along all lines and at wheel cylinders. If no external leaks are apparent, the problem is inside the master cylinder.

DISC BRAKES

Instead of the traditional expanding brakes that press outward against a circular drum, disc brake systems utilize a disc (rotor) with brake pads positioned on either side of it. Braking effect is achieved in a manner similar to the way you would squeeze a spinning phonograph record between your fingers. The disc (rotor) is a casting with cooling fins between the two braking surfaces. This enables air to circulate between the braking surfaces making them less sensitive to heat buildup and more resistant to fade. Dirt and water do not affect braking action since contaminants are thrown off by the centrifugal action of the rotor or scraped off the by the pads.

Also, the equal clamping action of the two brake pads tends to ensure uniform, straight line stops. Disc brakes are inherently self-adjusting. There are three general types of disc brake:

- A fixed caliper
- A floating caliper
- A sliding caliper

The fixed caliper design uses two pistons mounted on either side of the rotor (in each side of the caliper). The caliper is mounted rigidly and does not move.

The sliding and floating designs are quite similar. In fact, these two types are often lumped together. In both designs, the pad on the inside of the rotor is moved into contact with the rotor by hydraulic force. The caliper, which is not held in a fixed position, moves slightly, bringing the outside pad into contact with the rotor. There are various methods of attaching floating calipers. Some pivot at the bottom or top, and some slide on mounting bolts. In any event, the end result is the same.

All the vehicles covered in this book employ the sliding caliper design.

DRUM BRAKES

Drum brakes employ two brake shoes mounted on a stationary backing plate. These shoes are positioned inside a circular drum which rotates with the wheel assembly. The shoes are held in place by springs. This allows them to slide toward the drums (when they are applied) while keeping the linings and drums in alignment. The shoes are actuated by a wheel cylinder which is mounted at the top of the backing plate. When the brakes are applied, hydraulic pressure forces the wheel cylinder's actuating links outward. Since these links bear directly against the top of the brake shoes, the tops of the shoes are then forced against the inner side of the drum. This action forces the bottoms of the two shoes to contact the brake drum by rotating the entire assembly slightly (known as servo action). When pressure within the wheel cylinder is relaxed, return springs pull the shoes back away from the drum.

Most modern drum brakes are designed to self-adjust themselves during application when the vehicle is moving in reverse. This motion causes both shoes to rotate very slightly with the drum, rocking an adjusting lever, thereby causing rotation of the adjusting screw.

POWER BRAKE BOOSTER

Virtually all vehicles today use a vacuum assisted power brake system to multiply the braking force and reduce pedal effort. Since vacuum is always available when the engine is operating, the system is simple and efficient. A vacuum diaphragm is located on the front of the master cylinder and assists the driver in applying the brakes, reducing both the effort and travel the operator must put into moving the brake pedal.

The vacuum diaphragm housing is connected to the intake manifold by a vacuum hose. A check valve is placed at the point where the hose enters the diaphragm housing, so that during periods of low manifold vacuum brake assist will not be lost.

Depressing the brake pedal closes off the vacuum source and allows atmospheric pressure to enter on one side of the diaphragm. This causes the master cylinder pistons to move and apply the brakes. When the brake pedal is released, vacuum is applied to both sides of the diaphragm and springs return the diaphragm and master cylinder pistons to the released position.

If the vacuum supply fails, the brake pedal rod will contact the end of the master cylinder actuator rod and the system will apply the brakes without any power assistance. The driver will notice that much higher pedal effort is needed to stop the vehicle and that the pedal feels "harder" than usual.

Test for a system vacuum leak as described below:

1. Operate the engine at idle without touching the brake pedal for at least one minute.
2. Turn off the engine, and wait one minute.
3. Test for the presence of assist vacuum by depressing the brake pedal and releasing it several times. Light application will produce less and less pedal travel, if vacuum was present. If there is no vacuum, air is leaking into the system somewhere.

Test for system operation as follows:

4. Pump the brake pedal (with engine off) until the supply vacuum is entirely gone.
5. Put a light, steady pressure on the pedal.
6. Start the engine, and operate it at idle. If the system is operating, the brake pedal should fall toward the floor if constant pressure is maintained on the pedal.

BRAKE SYSTEM

Adjustments

DISC BRAKES

All disc brakes are inherently self-adjusting. No periodic adjustment is either necessary or possible.

DRUM BRAKES

➧ See Figure 1

➡Toyota trucks utilize self-adjusting brakes. The following procedure is necessary only after the brake shoes have been changed.

1. Place blocks under the front wheels so that the truck will not roll forward when it is jacked up at the rear.
2. Fully release the emergency brake.

3. Raise the rear of the truck and support the differential housing with jackstands.

⁂WARNING

Brake pads and shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

4. Remove the plug from the adjusting hole at the bottom of the backing plate.
5. Turn the adjusting starwheel to expand the shoes fully. While doing this, have a friend step on the brake pedal occasionally to center the shoes.
6. Tighten the shoes until the wheel will not turn when the pedal is released.
7. From this position back off the adjuster until the wheel turns with just a slight drag.
8. Back off the adjuster an additional five notches. The wheel should turn smoothly. If it does not, back off another two or three notches. Should this fail, check for worn or defective parts.
9. Adjust the other wheel in the same manner.

BRAKE PEDAL

Pedal Height

➧ See Figure 2

1. Measure the distance between the center (upper surface) of the pedal pad and the floor pad, not the carpet.
2. If out of specifications, loosen the brake light switch.
3. Loosen the locknut, then turn the pedal pushrod until the pedal height is within specifications:
   - 2WD Pick-Up — 5.83 inches (148mm)
   - 4WD Pick-Up — 5.71 inches (145mm)
   - Tacoma — 6.283-6.677 inches (159.6-169.6mm)
   - 1989-95 4Runner — 5.71-5.91 inches (145-150mm)
   - 1996 4Runner — 6.224-6.618 inches (158.1-168.1mm)
   - T100 (Extra cab 4WD) — 5.776-6.196 inches (146.7-156.7mm)
   - T100 (Except extra cab 4WD) — 5.894-6.287 inches (149.7-159.7mm)
   - 1989-90 Land Cruiser — 6.34-6.73 inches (161-171mm)
   - 1991-93 Land Cruiser — 7.09 inches (180mm)
   - 1994-96 Land Cruiser — 6.59-6.99 inches (167.5-177.5mm)
4. Tighten the pushrod locknut to 19 ft. lbs. (25 Nm).
5. Move the brake light switch until the plunger is just touching the pedal stopper. Tighten the switch.
6. Check the brake pedal free-play.

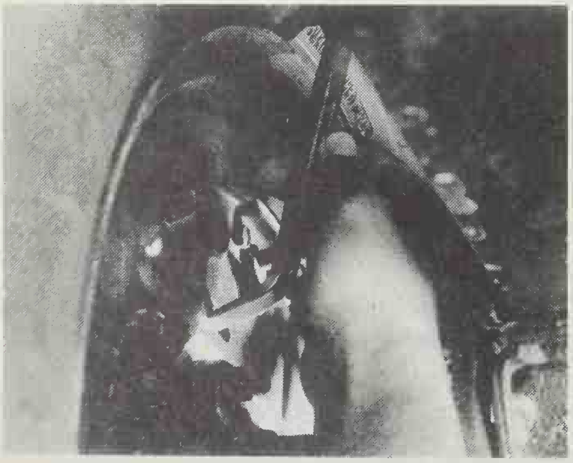
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Fig. 1 A special tool used to turn the adjuster wheel is available

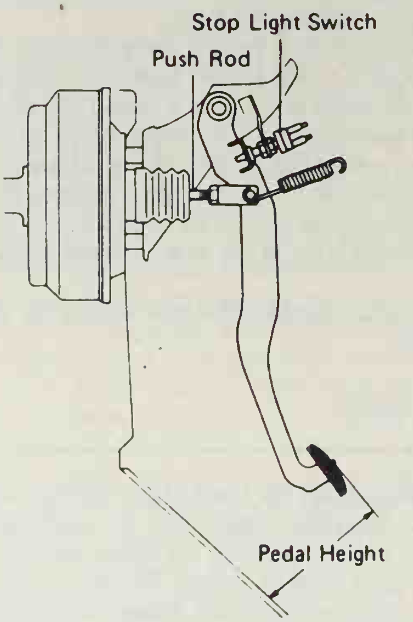

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Fig. 2 Pedal height is measured from the floor pad, not the carpet

Free-Play

➧ See Figure 3

1. With the engine turned off, depress the brake pedal several times until there is no vacuum left in the brake booster.
2. Push the pedal down until resistance is first felt. Measure this distance; it should be 0.12-0.24 inches (3-6mm).
3. Adjust the free-play by turning the pedal pushrod.

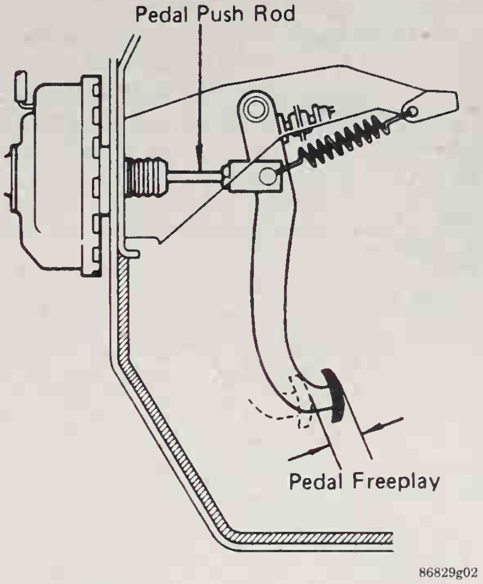


Fig. 3 Pedal free-play is the amount of motion before the brakes are applied

4. Start the engine and recheck the free-play.
5. Recheck the pedal height.

Brake Light Switch

REMOVAL & INSTALLATION

1. Disconnect the electrical harness at the switch.
2. Remove the locknut (closest to the pedal). Remove the switch from the brake pedal.

To install:

3. Insert the new switch and loosely install the locknut. Adjust the switch so that plunger at the tip of the switch is held in by the pedal in its at-rest position. Remember that the pedal holds the switch off; the brake lamps come on when the pedal moves away from the switch.
4. Once positioned, tighten the locknut and connect the wiring. Check the switch function by pressing the pedal. Have an assistant observe the brake lamps for proper operation.

Master Cylinder

REMOVAL & INSTALLATION

See Figures 4, 5 and 6

WARNING

Be careful not to spill brake fluid on the painted surfaces. It will damage the paint. If a spill occurs, flush the area with plenty of fresh water.

1. Bleed the air from the master cylinder.
2. Unplug the fluid level warning switch connector.
3. Use a syringe or similar tool to remove as much fluid as possible from the reservoir.
4. Carefully disconnect the brake lines at the master cylinder. To prevent line damage, use a line wrench. Regular open-end wrenches are NOT recommended. Take great care not to bend or deform the lines. Plug the lines to keep dirt from entering.
5. Remove the nuts holding the master cylinder to the booster. Unbolt the 3-way or 4-way union. When removing the cylinder, take care to recover the clamps, gaskets, etc.

To install:

6. Using a new gasket, install the master cylinder onto the brake booster. Tighten the mounting nuts to 9 ft. lbs. (13 Nm).
7. Attach the union. Carefully connect the brake tubes, initially threading them into place by hand. Once properly engaged, tighten the fittings to 11 ft. lbs. (15 Nm).
8. Connect the wiring harness for the brake fluid switch.
9. Fill the brake fluid reservoir with fluid to the MAX line. Check the leakage.
10. Bleed the brake system. Check again for any leakage.
11. Check and adjust the brake pedal.

Power Brake Booster

REMOVAL & INSTALLATION

See Figures 7, 8 and 9

1. Remove the master cylinder.
2. At the brake pedal, remove the clip and separate the clevis from the pedal.
3. Remove the pedal return spring.
4. Disconnect the vacuum hose from the booster.
5. Loosen the four nuts, then pull out the vacuum booster, bracket and gasket.

To install:

Some models employ a spacer and additional gaskets at the firewall.

6. Using a new gasket, install the booster, then tighten the mounting bolts to 9 ft. lbs. (13 Nm).
7. Install the clevis pin to the clevis through the brake pedal. Secure the pin with the clip.
8. Install the pedal return spring.

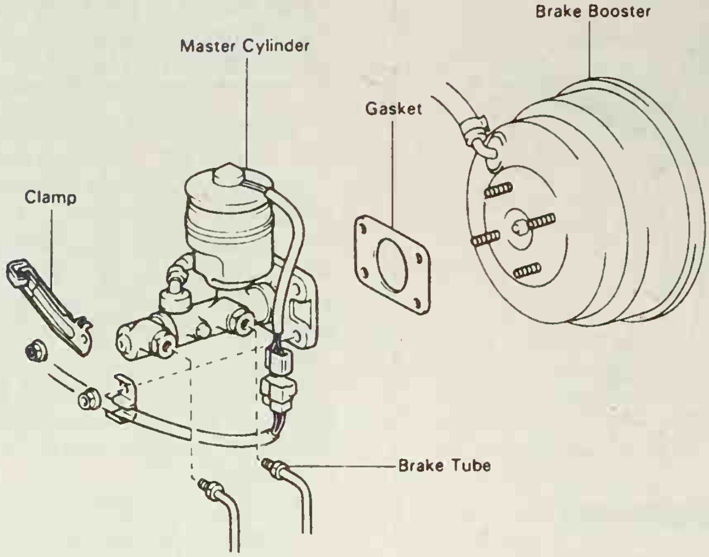

Brake Booster
Master Cylinder
Gasket
Clamp
Brake Tube
86829g06

Fig. 4 Exploded view of a common brake master cylinder mounting found on Toyotas

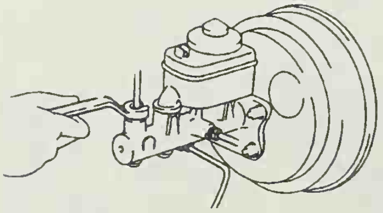


Fig. 5 Using a line wrench, loosen the brake fittings on the cylinder

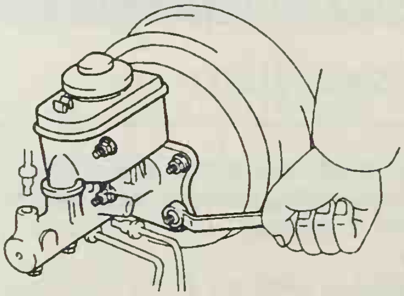


Fig. 6 Remove the mounting nuts retaining the master cylinder to the brake booster

9. Adjust the length of the booster pushrod as follows:
   a. Install the gasket to the master cylinder.
   b. Set the SST 09737-00010 or equivalent on the gasket, then lower the pin until its tip slightly touches the piston.
   c. Turn the tool upside down and position it on the booster.
   d. Measure the clearance between the booster pushrod and the pin head. It should be null.
   e. Adjust the booster pushrod length until the pushrod lightly touches the pin head. While doing this depress the brake pedal enough so that the pushrod sticks out.
10. Install the master cylinder.
11. Attach the vacuum hose to the booster.
12. Fill the reservoir with brake fluid, then bleed the system.
13. Check for leakage.
14. Check and adjust the brake pedal.

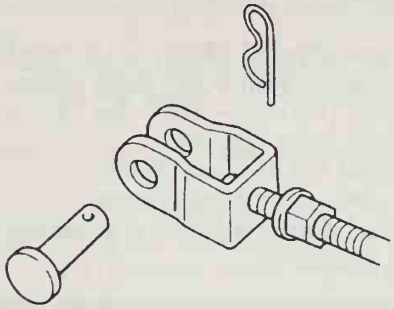


Fig. 7 Slide the pin through the clevis, then secure it with the clip

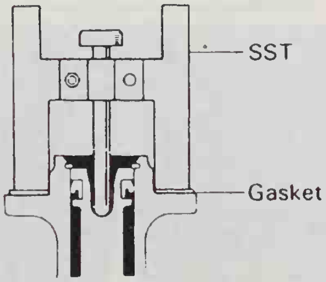


Fig. 8 Install the tool on top of the gasket as shown

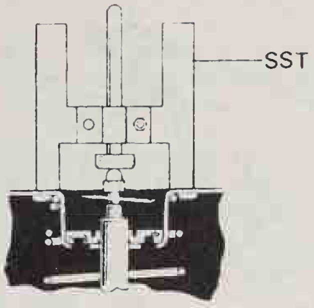


Fig. 9 Set the tool on the gasket, then lower the pin until its tip slightly touches the piston

Load Sensing Proportioning (LSP) and Bypass Valve (BV)

The purpose of this valve is to control the fluid pressure applied to the brakes to prevent rear wheel lock-up during weight transfer at high speed stops.

REMOVAL & INSTALLATION

◗ See Figures 10, 11 and 12

1. Disconnect the shackle from the bracket. Remove the cotter pin, then the nut and cushion retainer. Disconnect the shackle and remove the cushions and collar.
2. Disconnect the brake lines attached to the valve. Plug the lines to keep dirt from entering.
3. Remove the mounting bolt, if used, and remove the valve.

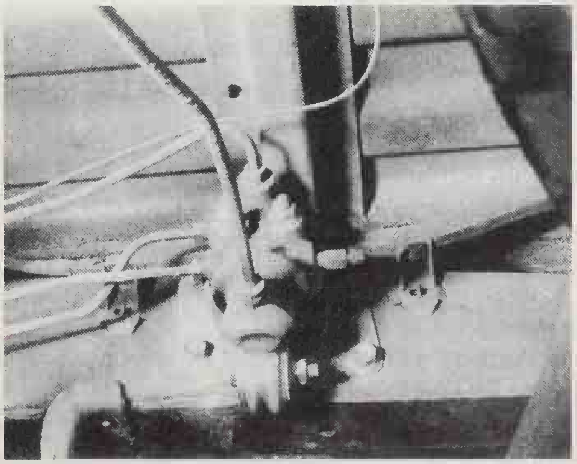


Fig. 10 The load sensing valve can be found secured to the frame rail

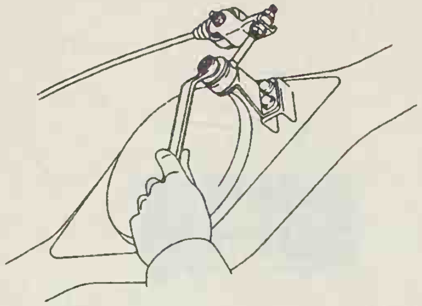


Fig. 11 Detach the shackle from the bracket

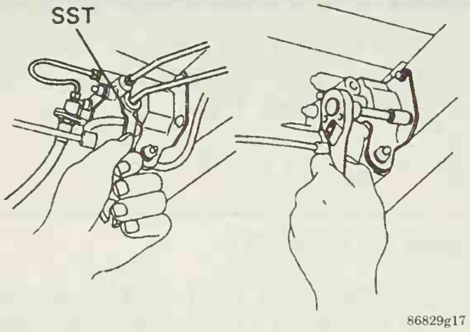


Fig. 12 Disconnect the lines attached to the sensing valve, then remove the bolts securing it

To install:

➡This valve can not be rebuilt. It must be replaced.

4. Install the LSP and BV assembly to the frame, tighten to 19-22 ft. lbs. (25-29 Nm).
5. Install the shackle to the load sensing spring.
6. Attach the shackle to the shackle bracket, tighten to 9 ft. lbs. (13 Nm). Install a new cotter pin.
7. Attach the brake lines, tighten to 11 ft. lbs. (15 Nm).
8. Set the valve body as follows:
   a. When pulling the load sensing spring, confirm that the valve piston moves down slowly.
   b. Position the valve body so that the valve piston lightly contacts the load sensing spring.
   c. Tighten the valve body mounting nuts to 9 ft. lbs. (13 Nm).
9. Bleed the brake system.

ADJUSTMENT

➧ See Figure 13

➡This is an initial adjustment which should bring the valve close to specifications. Since it requires the use of pressure gauges and determines the exact weight of the load on the rear axle, it is not practical for the owner/mechanic. Have the final adjustments performed at a reputable shop as soon as possible.

1. Pull down the load sensing spring to determine that the piston moves slowly.
2. Set the valve body so that the piston lightly touches the load sensing spring.
3. Tighten the mounting bolts.
4. Adjust the length of the shackle. Lengthening the distance between the centers lowers the pressure; shortening the distance raises the pressure. One full turn of the nut increases pressure about 20 psi. on Land Cruiser or about 11-14 psi (75-96 kPa) on all other vehicles. Initial length of this link should be:
   - Pick-Up and 4Runner (1989-95) — 3.54 inches (90mm)
   - Land Cruiser (1989-90) — 3.07 inches (78mm)
   - Land Cruiser (1991-96) — 3.54 inches (90mm)
   - T100 — 4.72 inches (120mm)
   - Tacoma 2WD — 3.07 inches (78mm)
   - Tacoma 4WD — 4.72 inches (120mm)
5. If the initial distance is correct, fluid metering should be very close to specification.

Brake Hoses and Lines

REMOVAL & INSTALLATION

Metal lines and rubber brake hoses should be checked frequently for leaks and external damage. Metal lines and particularly prone to crushing and kinking under the vehicle. Any such deformation can restrict the proper flow of fluid and therefore impair braking at the wheels. Rubber hoses should be checked

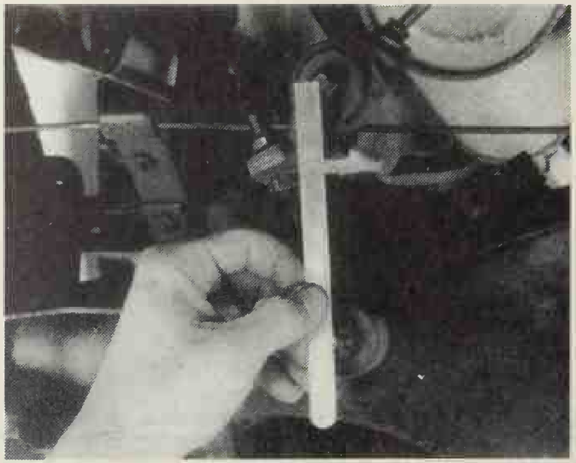


Fig. 13 Measure the distance between the centers of the shackles

for cracking or scraping; such damage can create a weak spot in the hose and it could fail under pressure.

Any time the lines are removed or disconnected, extreme cleanliness must be observed. The slightest bit of dirt in the system can plug a fluid port and render the brakes defective. Clean all joints and connections before disassembly (use a stiff brush and clean brake fluid) and plug the lines and ports as soon as they are opened. New lines and hoses should be blown or flushed clean before installation to remove any contamination. To replace a line or hose:

Brake Hose

1. Raise the end of the vehicle which contains the hose to be repaired, then support the vehicle safely using jackstands.
2. If necessary, remove the wheel for easier access to the hose.
3. Disconnect the hose from the wheel cylinder or caliper and plug the opening to avoid excessive fluid loss or contamination.
4. Disconnect the hose from the brake line and plug the openings to avoid excessive fluid loss or contamination.

To install:

5. Install the brake hose to the brake line and tighten to 14 ft. lbs. (19 Nm) for rear brakes or 18 ft. lbs. (24 Nm) for front brakes.
6. If installing a front brake hose, make sure the hose is routed properly.
7. Install the hose to the wheel cylinder or caliper using NEW washers, then tighten the retainer to 36 ft. lbs. (49 Nm).
8. Properly bleed the brake system, then check the connections for leaks.
9. Remove the supports and carefully lower the vehicle.

Brake Line

There are 2 options available when replacing a brake line. The first, and probably most preferable, is to replace the entire line using a line of similar length which is already equipped with machined flared ends. Such lines are usually available from auto parts stores and usually require only a minimum of bending in order to properly fit then to the vehicle. The second option is to bend and flare the entire replacement line (or a repair section of line) using the appropriate tools.

Buying a line with machined flares is usually preferable because of the time and effort saved, not to mention the cost of special tools if they are not readily available. Also, machined flares are usually of a much higher quality than those produced by hand flaring tools or kits.

1. Raise the end of the vehicle which contains the hose to be repaired, then support the vehicle safely using jackstands.
2. Remove the components necessary for access to the brake line which is being replaced.
3. Disconnect the fittings at each end of the line, then plug the openings to prevent excessive fluid loss or contamination.
4. Trace the line from one end to the other and disconnect the line from any retaining clips, then remove the line from the vehicle.

To install:

5. Try to obtain a replacement line that is the same length as the line that was removed. If the line is longer, you will have to cut it and flare the end. If you have decided to repair a portion of the line, see the procedure on brake line flaring.
6. Use a suitable tubing bender to make the necessary bends in the line. Work slowly and carefully; try to make the bends look as close as possible to those on the line being replaced.

➡ When bending the brake line, be careful not to kink or crack the line. If the brake line becomes kinked or cracked, it must be replaced.

7. Before installing the brake line, flush it with brake cleaner to remove any dirt or foreign material.
8. Install the line into the vehicle. Be sure to attach the line to the retaining clips, as necessary. Make sure the replacement brake line does not contact any components that could rub the line and cause a leak.
9. Connect the brake line fittings and tighten to 18 ft. lbs. (24 Nm), except for the rear line-to-hose fitting which should be tightened to 14 ft. lbs. (19 Nm).
10. Properly bleed the brake system and check for leaks.
11. Install any removed components, then remove the supports and carefully lower the vehicle.

BRAKE LINE FLARING

Use only brake line tubing approved for automotive use; never use copper tubing. Whenever possible, try to work with brake lines that are already cut to the length needed. These lines are available at most auto parts stores and have machine made flares, the quality of which is hard to duplicate with most of the available inexpensive flaring kits.

When the brakes are applied, there is a great amount of pressure developed in the hydraulic system. An improperly formed flare can leak with resultant loss of stopping power. If you have never formed a double-flare, take time to familiarize yourself with the flaring kit; practice forming double-flares on scrap tubing until you are satisfied with the results.

The following procedure applies to the SA9193BR flaring kit, but should be similar to commercially available brake-line flaring kits. If these instructions differ in any way from those in your kit, follow the instructions in the kit.

1. Determine the length necessary for the replacement or repair and allow an additional 1/8 in. (3.2mm) for each flare. Select a length of tubing according to the repair/replacement charts in the figure, then cut the brake line to the necessary length using an appropriate saw. Do not use a tubing cutter.
2. Square the end of the tube with a file and chamfer the edges. Remove burrs from the inside and outside diameters of the cut line using a deburring tool.
3. Install the required fittings onto the line.
4. Install SA9193BR, or an equivalent flaring tool, into a vice and install the handle into the operating cam.
5. Loosen the die clamp screw and rotate the locking plate to expose the die carrier opening.
6. Select the required die set (4.75mm DIN) and install in the carrier with the full side of either half facing clamp screw and counter bore of both halves facing punch turret.
7. Insert the prepared line through the rear of the die and push forward until the line end is flush with the die face.
8. Make sure the rear of both halves of the die rest against the hexagon die stops, then rotate the locking plate to the fully

closed position and clamp the die firmly by tightening the clamp screw.

9. Rotate the punch turret until the appropriate size (4.75mm DIN) points towards the open end of the line to be flared.
10. Pull the operating handle against the line resistance in order to create the flare, then return the handle to the original position.
11. Release the clamp screw and rotate the locking plate to the open position.
12. Remove the die set and line, then separate by gently tapping both halves on the bench. Inspect the flare for proper size and shape. Measurement should be 0.272-0.286 in. (6.92-7.28mm).
13. If necessary, repeat the steps for the other end of the line or for the end of the line which is being repaired.
14. Bend the replacement line or section using SA91108NE, or an equivalent line bending tool.
15. If repairing the original line, join the old and new sections using a female union and tighten.

Bleeding the Brake System

It is necessary to bleed the hydraulic system any time the system has been opened or has trapped air within the fluid lines. It may be necessary to bleed the system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder.

If a line is disconnected at one wheel only, generally only that brake needs bleeding. If lines are disconnected at any fitting between the master cylinder and the brake, the system served by the disconnected pipe must be bled.

✲✲WARNING

Do not allow brake fluid to splash or spill onto painted surfaces; the paint will be damaged. If spillage occurs, flush the area immediately with clean water.

MASTER CYLINDER

➧ See Figures 14, 15 and 16

If the master cylinder has been removed, the lines disconnected or the reservoir allowed to run dry, the cylinder must be bled before the lines are bled. To bleed the master cylinder:

1. Check the level of the fluid in the reservoir. If necessary, fill with fluid.
2. Disconnect the brake lines from the master cylinder. Plug the lines to keep dirt from entering.
3. Place a pan or rags under the cylinder.
4. Have an assistant slowly depress the brake pedal and hold it down.
5. Block off the outlet ports with your fingers. Be sure to wear gloves. Have the assistant release the pedal. Make a tight seal with your fingers; do not allow the cylinder to ingest air when the pedal is released.
6. Repeat three or four times.
7. Connect the brake lines to the master cylinder and top up the fluid reservoir.

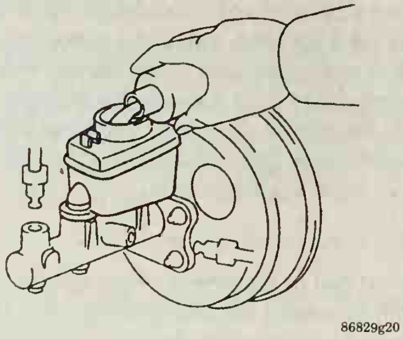


Fig. 14 Fill the correct type of brake fluid into the reservoir

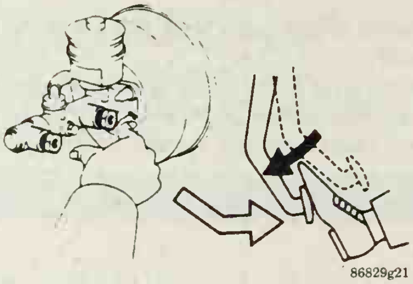


Fig. 15 Depress the brake pedal . . .

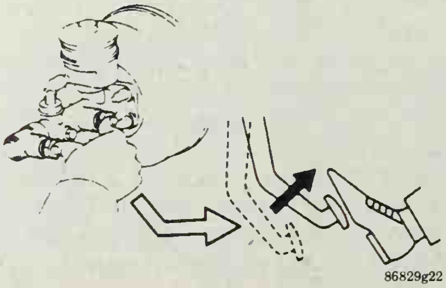


Fig. 16 . . . then, block the ports with your fingers and release the pedal

LINES AND WHEEL CIRCUITS

➧ **See Figure 17**

1. Insert a clear vinyl tube onto the bleeder plug at the wheel. If all four wheels are to be bled, begin with the right rear.
2. Insert the other end of the tube into a jar which is half filled with brake fluid. Make sure the end is submerged in the fluid.
3. Have an assistant slowly pump the brake pedal several times. On the last pump, have the assistant hold the pedal fully depressed. While the pedal is depressed, open the bleeder plug until fluid starts to run out, then close the plug.

➡If the brake pedal is pumped too fast, small air bubbles will form in the brake fluid which will be very difficult to remove.

4. Repeat this procedure until no air bubbles are visible in the hose. Close the bleeder port.

➡Constantly replenish the brake fluid in the master cylinder reservoir, so that it does not run out during bleeding.

5. If bleeding the entire system, repeat the procedure at the left rear wheel, the right front wheel and the left front wheel in that order.
6. Bleed the load sensing proportioning and bypass valve.

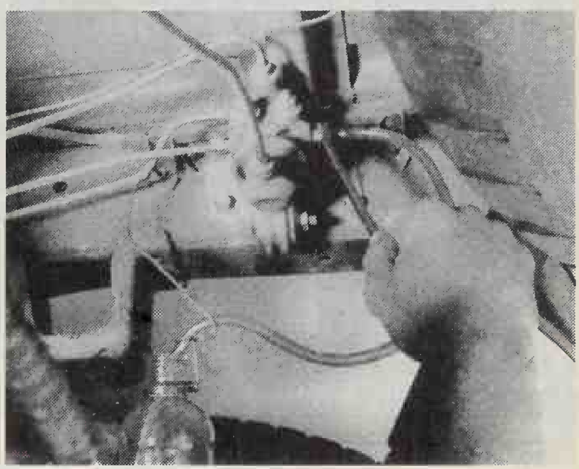


Fig. 17 A line wrench can be used to loosen the bleeder plug

FRONT DISC BRAKES

⁂CAUTION

Brake pads may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

Brake Pads

WEAR INDICATORS

The front disc brake pads are equipped with a metal tab which will come into contact with the rotor after the friction surface material has worn near its usable minimum. The wear indicators make a constant, distinct metallic sound that should be easily heard. The sound has been described as similar to either fingernails on a blackboard or a field full of crickets. The key to recognizing that it is the wear indicators and not some other brake noise is that the sound is heard when the vehicle is being driven WITHOUT the brakes applied. It may or may not be present under braking and is heard during normal driving.

It should also be noted that any disc brake system, by its design, cannot be made to work silently under all conditions. Each system includes various shims, plates, cushions and brackets to suppress brake noise, but no system can completely silence all noises. Some brake noise, either high or low frequency, can be controlled and perhaps lessened, but cannot be totally eliminated.

INSPECTION

➧ **See Figure 18**

The front brake pads may be inspected without removal. With the front end elevated and supported, remove the wheel(s). Unlock the steering column lock and turn the wheel so that the brake caliper is out from under the fender.

View the pads, inner and outer, through the cut-out in the center of the caliper. Remember to look at the thickness of the pad friction material (the part that actually presses on the disc) rather than the thickness of the backing plate which does not change with wear.

Keep in mind that you are looking at the profile of the pad, not the whole thing. Brake pads can wear on a taper which may not be visible through the window. It is also not possible to check the contact surface for cracking or scoring from this position. This quick check can be helpful only as a reference; detailed inspection requires pad removal.

REMOVAL & INSTALLATION

2WD Vehicles

PD60 AND 66 TYPE BRAKES

➧ **See Figures 19, 20 and 21**

1. Raise the front of the truck and safely support it with jackstands.
2. Remove the lug nuts and the wheel.
3. Remove the lower installation bolt from the torque plate. The torque plate is the framework that holds the caliper.

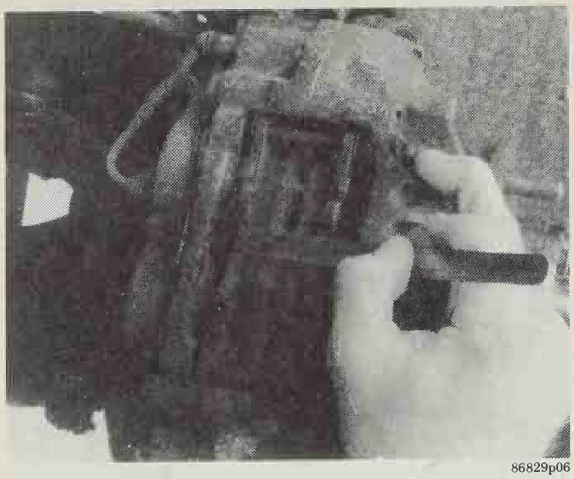


Fig. 18 The pad thickness can be measured through the inspection window

4. Pivot the caliper assembly upwards and suspend it from the suspension with a wire. Do NOT disconnect the brake line, but take care not to stretch it.
5. Remove the 2 anti-squeal springs and lift out the brake pads.
6. Remove the 2 anti-squeal shims and the 4 pad support plates. Pull the 2 pad wear indicator off the pads.
7. Check the pad thickness and replace the pads if they are less than 0.039 in. (1mm) thick. New pads measure approximately 0.374-0.472 in. (9.6-12.0mm) thick depending on the vehicle.

➡This minimum thickness measurement may disagree with your state inspection laws.

To install:

8. Install the 4 pad support plates into the torque plate.
9. Install a new pad wear indicator plate to each pad.
10. Install the large anti-squeal shim to the back of the outer pad (PD 60) or to the back of each pad (PD 66) and then

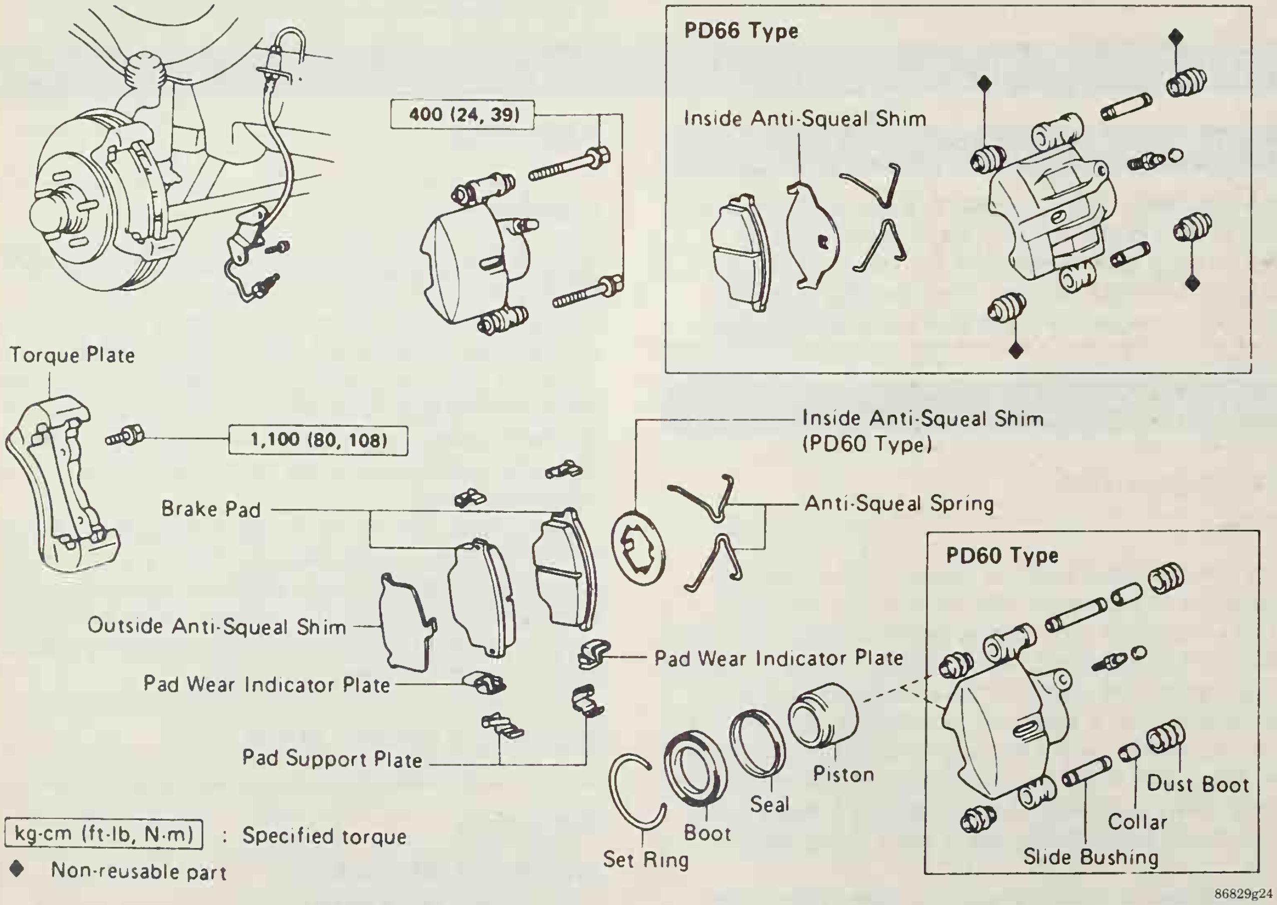

PD66 Type
Inside Anti-Squeal Shim
400 (24, 39)
Torque Plate
1,100 (80, 108)
Brake Pad
Inside Anti-Squeal Shim (PD60 Type)
Anti-Squeal Spring
PD60 Type
Outside Anti-Squeal Shim
Pad Wear Indicator Plate
Pad Wear Indicator Plate
Pad Support Plate
Piston
Seal
Boot
Set Ring
Dust Boot
Collar
Slide Bushing
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
86829g24

Fig. 19 Exploded view of the PD 60 and 66 type brake components

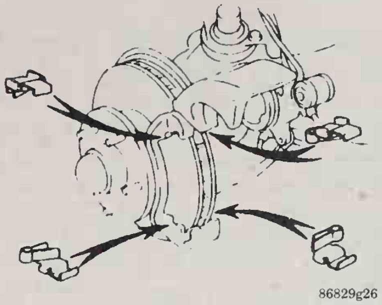


Fig. 20 Install the pad support plates as shown

position both pads into the torque plate. Install the anti-squeal springs in place.

➡**When installing new brake pads, make sure your hands are clean. Do not allow any grease or oil to touch the contact face of the pads or the brakes may not stop the truck properly.**

11. Remove a small amount of fluid from the reservoir, using a syringe or similar tool. Use a C-clamp or hammer handle and press the caliper piston back into the housing.

⁕⁕WARNING

Never press the piston into the caliper when the pads are out on both sides of the truck. The opposite piston may pop completely out of the caliper. This may spoil your afternoon.

12. For PD 60 types, press the round anti-squeal shim over the caliper piston; position the caliper over the torque plate so the dust boot is not pinched.

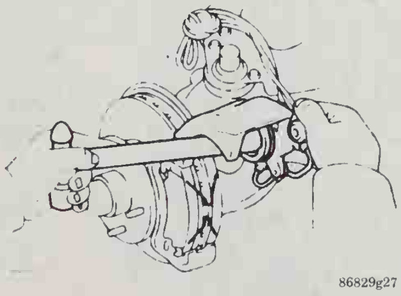


Fig. 21 Use a C-clamp or hammer handle to seat the caliper piston back into the housing

13. Swing the caliper down and fit the lower bolt. Tighten it to 29 ft. lbs.. (39 Nm).

14. Install the wheel and lower the truck. Check the brake fluid level in the reservoir and fill to the max line if necessary. (The level should have risen when the piston was pushed back.)

15. Apply the parking brake and put the vehicle in Park or Neutral. Step on the brake pedal two or three times. The first pedal application will be due to the pistons being pushed back. The pedal travel should be normal after two or three pumps. Do NOT drive the vehicle until the pedal has a normal feel. If necessary, bleed the brakes to remove pedal sponginess.

➡**Braking should be moderate for the first 5 miles (8 km) or so until the new pads seat correctly. The new pads will bed best if put through several moderate heating and cooling cycles. Avoid hard braking until the brakes have experienced several long, slow stops with time to cool in between. Taking the time to properly bed the brakes will yield quieter operation, more efficient stopping and contribute to extended brake life.**

FS17 AND 18 TYPE BRAKES

➧ See Figures 22, 23 and 24

1. Remove the hub cap and loosen the lug nuts.
2. Raise the front of the truck and safely support it with jackstands.
3. Remove the lug nuts and the wheel.
4. Remove the caliper slide pin on the sub-pin (lower) side.
5. Swivel the caliper up and away from the torque plate. Tie the caliper to a suspension member so it is out of the way. Do not disconnect the brake line.
6. Lift the 2 brake pads out of the torque plate. Remove the anti-squeal shim.
7. Remove the 4 pad support plates. Pull the 2 pad wear indicator plates off the pads.
8. Check the pad thickness and replace the pads if they are less than 0.03 in. (1mm) thick. New pads measure approximately 0.374 in. (9.6mm) thick.

➡**This minimum thickness measurement may disagree with your state inspection laws.**

To install:

9. Install the 4 pad support plates into the torque plate.
10. Install a new pad wear indicator plate to the bottom of each pad.
11. Install the anti-squeal shim to the back of the outer pad and then position both pads into the torque plate.

⁕⁕WARNING

When installing new brake pads, make sure your hands are clean. Do not allow any grease or oil to touch the contact face of the pads or the brakes will not stop the truck properly.

12. Use a syringe or similar tool to remove some fluid from the reservoir. Use a C-clamp or hammer handle and press the caliper piston back into the housing.
13. Untie the caliper and swivel it back into position over the torque plate so that the dust boot is not pinched. Install the slide pin and tighten it to 65 ft. lbs. (88 Nm).

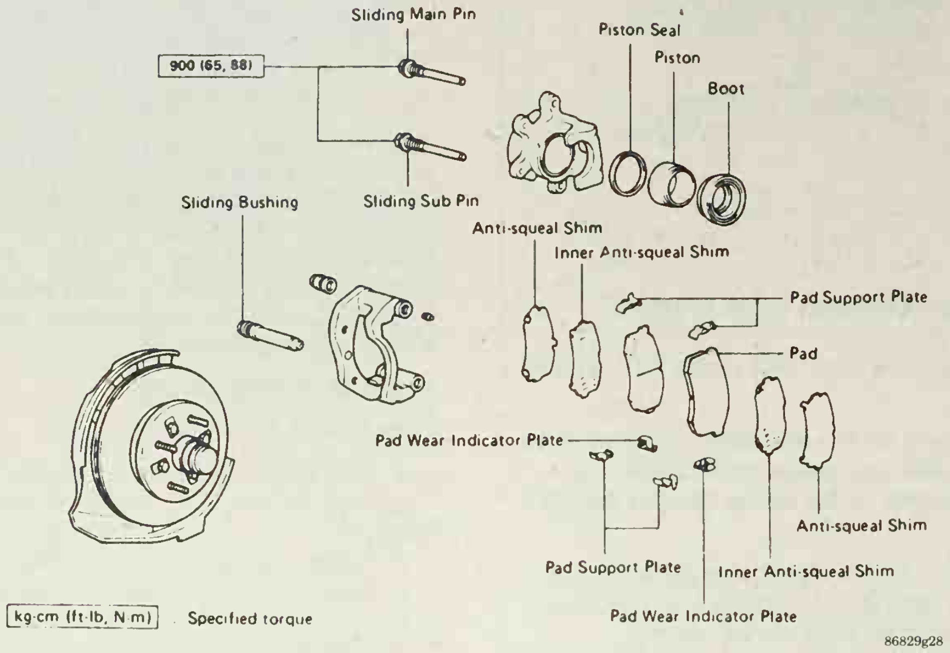

Sliding Main Pin
900 (65, 88)
Piston Seal
Piston
Boot
Sliding Bushing
Sliding Sub Pin
Anti-squeal Shim
Inner Anti-squeal Shim
Pad Support Plate
Pad
Pad Wear Indicator Plate
Anti-squeal Shim
Pad Support Plate
Inner Anti-squeal Shim
Pad Wear Indicator Plate
kg-cm (ft-lb, N-m) : Specified torque
86829g28

Fig. 22 Exploded view of the FS17 and FS18 type brake components

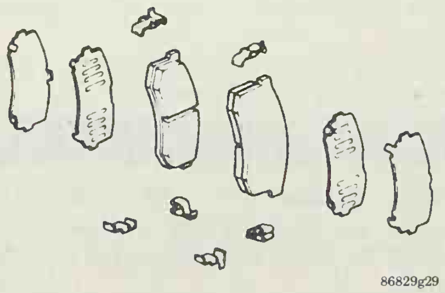


Fig. 23 Exploded view of the brake pad components on the FS17 and 18 type brakes

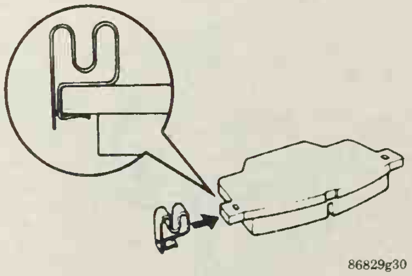


Fig. 24 The wear indicators are installed on the side of the brake pad as shown

14. Check the condition of the cylinder side bushing boot.
15. Install the wheel and lower the truck.
16. Check the brake fluid level in the reservoir and fill to the max line if necessary. (The level should have risen when the piston was pushed back.)
17. Apply the parking brake and put the vehicle in Park or Neutral. Step on the brake pedal two or three times. The first pedal application will be due to the pistons being pushed back. The pedal travel should be normal after two or three pumps. Do NOT drive the vehicle until the pedal has a normal feel. If necessary, bleed the brakes to remove pedal sponginess.

➡Braking should be moderate for the first 5 miles (8 km) or so until the new pads seat correctly. The new pads will bed best if put through several moderate heating and cooling cycles. Avoid hard braking until the brakes have experienced several long, slow stops with time to cool in between. Taking the time to properly bed the brakes will yield quieter operation, more efficient stopping and contribute to extended brake life.

4WD Vehicles

▶ See Figures 25, 26, 27, 28, 29 and 30

1. Raise the front of the truck, support it on jackstands, and remove the front wheel.
2. Pull out the wire clip at the ends of the pad pins.
3. Remove the pins. Remove the anti-rattle spring (W-shaped on older trucks), the brake pads and the four anti-squeal shims.
4. Check the pad thickness and replace the pads if they are less than 0.03 in. (1mm) thick. New pads measure approximately 0.374 in. (9.6mm) thick.

➡This minimum thickness measurement may disagree with your state inspection laws.

5. Check the pins for straightness and wear, and replace if necessary.

To install:

6. Use a syringe or similar tool to remove a small amount of fluid from the master cylinder reservoir.

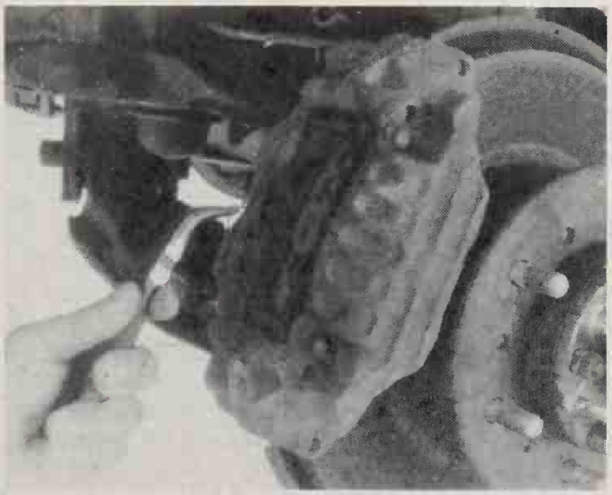

86829p07

Fig. 25 Remove the wire clips securing the pins

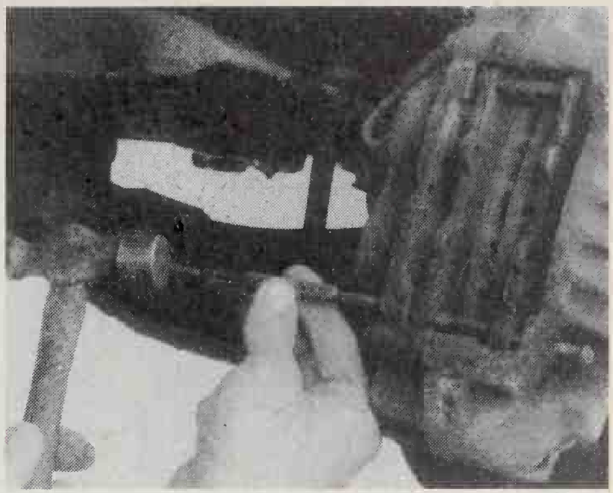

86829p08

Fig. 26 The pins can be removed with a drift

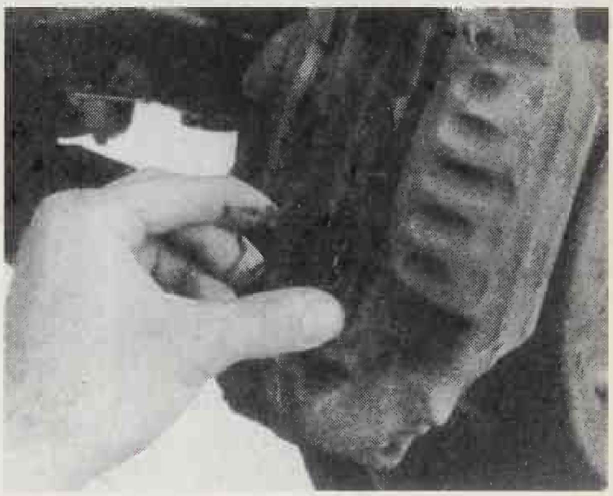

86829p10

Fig. 27 Remove the anti-rattle clips from the pads

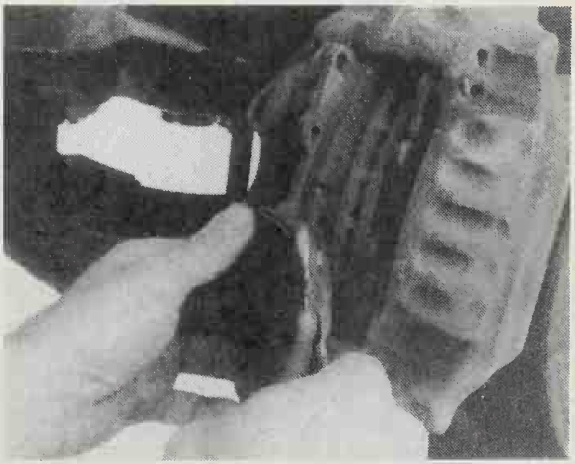

86829p11

Fig. 28 The pads can be removed with a pair of needle-nose pliers

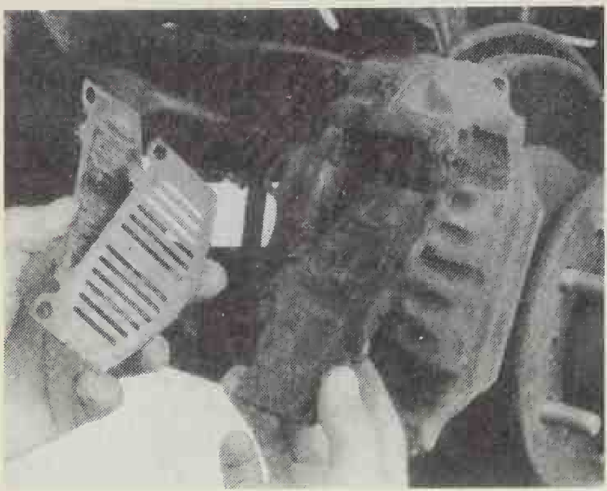


Fig. 29 Remove the shims from the back of the pad

7. Use a C-clamp or hammer handle and press the caliper pistons back into the housing.

➡Never press the pistons into the caliper when the pads are out on both sides of the truck.

8. Install the 4 anti-squeal shims so that the black shims are between the silver shims and the brake pad.
9. Install the brake pads. Be very careful not to get grease or oil on the inner surfaces of the pads.
10. Install the anti-rattle spring.
11. Slide the 2 pad retaining pins through the caliper and pads and install the retaining clip.
12. Install the wheel and lower the truck. Bleed the brakes and road test the vehicle.
13. Check the brake fluid level in the reservoir and fill to the max line if necessary. (The level should have risen when the piston was pushed back.)
14. Apply the parking brake and put the vehicle in Park or Neutral. Step on the brake pedal two or three times. The first pedal application will be due to the pistons being pushed back. The pedal travel should be normal after two or three pumps.

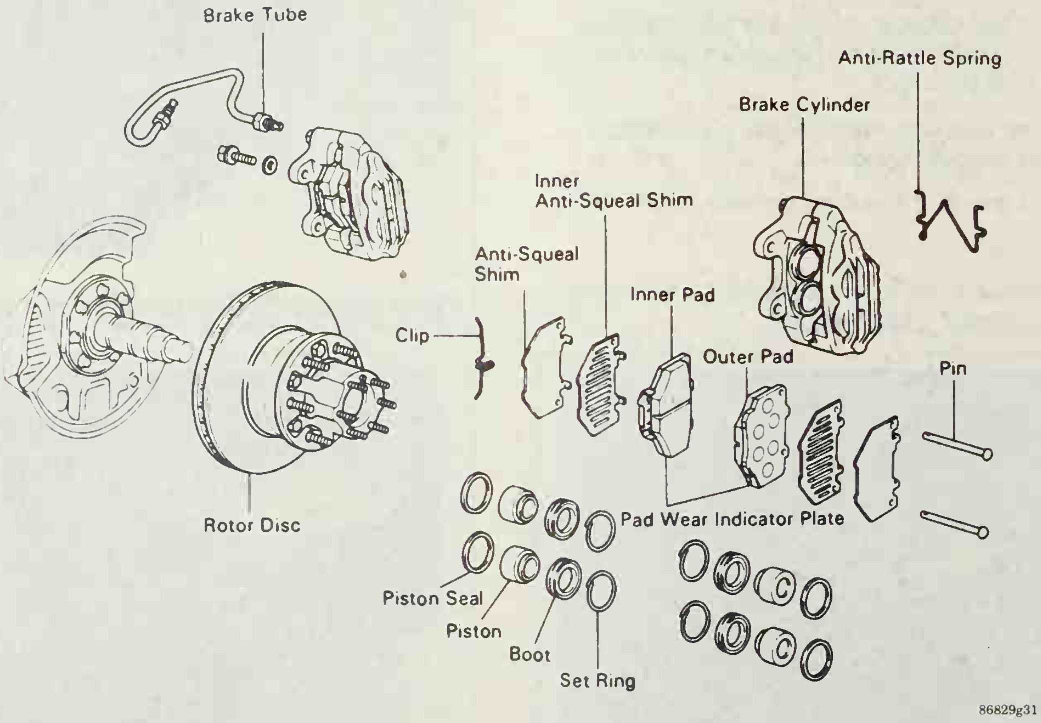

Brake Tube
Anti-Rattle Spring
Brake Cylinder
Inner Anti-Squeal Shim
Anti-Squeal Shim
Inner Pad
Clip
Outer Pad
Pin
Pad Wear Indicator Plate
Rotor Disc
Piston Seal
Piston
Boot
Set Ring
86829g31

Fig. 30 Exploded view of the 4WD front brake components — 1991 Land Cruiser shown

Do NOT drive the vehicle until the pedal has a normal feel. If necessary, bleed the brakes to remove pedal sponginess.

➡Braking should be moderate for the first 5 miles (8 km) or so until the new pads seat correctly. The new pads will bed best if put through several moderate heating and cooling cycles. Avoid hard braking until the brakes have experienced several long, slow stops with time to cool in between. Taking the time to properly bed the brakes will yield quieter operation, more efficient stopping and contribute to extended brake life.

Brake Caliper

REMOVAL & INSTALLATION

2WD Vehicles

1. Elevate and safely support the vehicle.
2. Remove the wheel.
3. Disconnect the brake line from the caliper.
4. Remove the bolts holding the caliper to the torque plate.
5. Remove the caliper from the torque plate.
6. Remove the pads and shims.

To install:

7. Install the pads and shims.
8. Fit the caliper into position. Install the two retaining or slide bolts, then tighten to:
   - FS-17 or 18 brakes — 65 ft. lbs. (88 Nm)
   - PD 60 or 66 brakes — 29 ft. lbs. (39 Nm)
   - T100 ½ ton — 27 ft. lbs. (36 Nm)
   - T100 1 ton — 29 ft. lbs. (39 Nm)
9. Install the brake line, tightening the fitting to 11-22 ft. lbs. (15-30 Nm).
10. Install the wheel.
11. Lower the vehicle to the ground. Bleed the brakes and road test the vehicle.

4WD Vehicles

See Figures 31, 32 and 33

1. Raise the front of the truck, support it on jackstands, and remove the front wheel.
2. Plug the vent hole on the master cylinder cap to prevent fluid leak. Loosen the brake line from the caliper, being careful not to deform the fittings.
3. Remove the 2 caliper mounting bolts, and remove the caliper.
4. Pull out the two wire clips at the ends of the pad pins.
5. Pull out the pads and anti-rattle spring.
6. Remove the brake pads, and the anti-squeal shims.

To install:

7. Position the caliper and install the mounting bolts. Tighten the caliper mounting bolts to 90 ft. lbs. (123 Nm). Be certain to position the shims correctly.
8. Connect the brake line to the caliper. On all models except 1991-96 Land Cruisers, tighten the line fitting to 11 ft. lbs. (15 Nm). For 1991-96 Land Cruisers, tighten it to 22 ft. lbs. (30 Nm).
9. Install the brake pads.

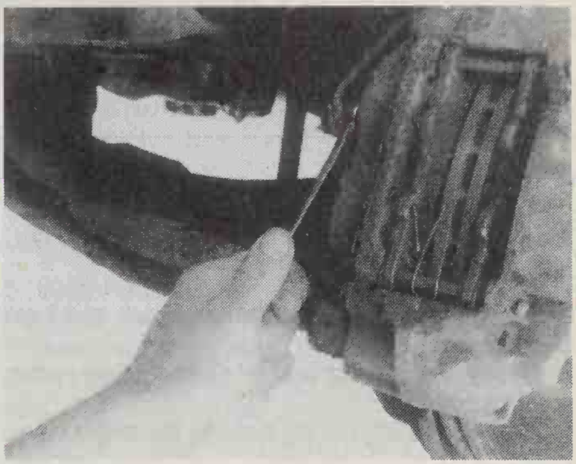

86829p15

Fig. 31 With a line wrench, loosen the brake line from the caliper

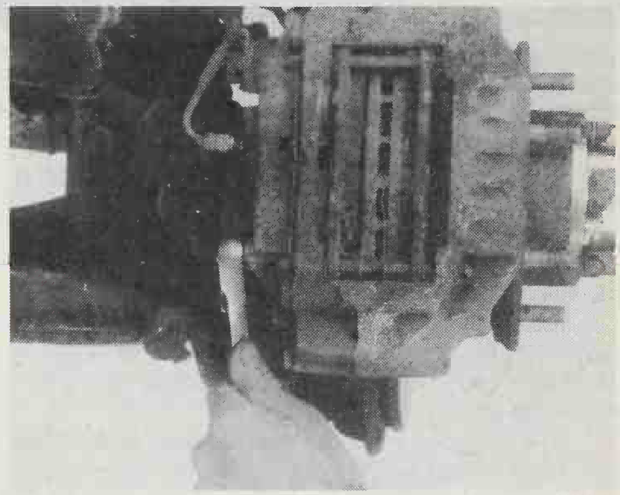

86829p14

Fig. 32 Remove the upper and lower mounting bolts

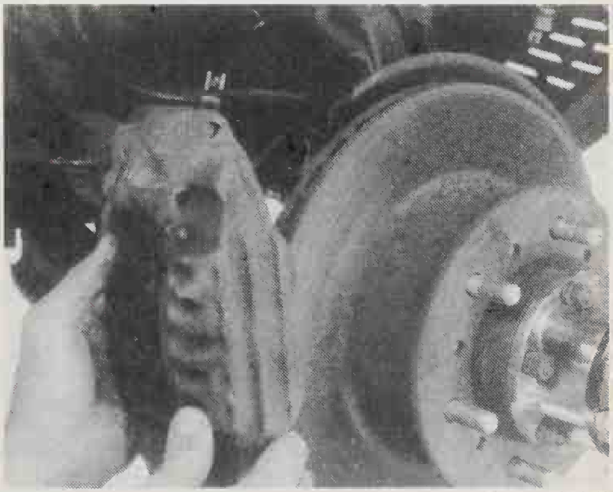

86829p13

Fig. 33 Slide the caliper assembly off of the rotor

10. Install the wheel and lower the truck. Bleed the brakes and road test the vehicle.

OVERHAUL

2WD Vehicles

1. Raise the front of the truck and support with safety stands. Remove the wheels.
2. Remove the caliper.
3. Remove the slide bushings, pin dust boots and 2 collars (PD60 only).
4. Carefully pry the dust boot set ring out of the caliper. Remove the dust boot.
5. Insert a piece cloth or rag between the caliper claw and the piston.
6. Apply compressed air to the brake line union to force the piston out of its bore. Be careful; the piston may come out forcefully.

⁂CAUTION

Keep fingers away from the front of the piston during removal. Injury may occur when the piston comes out.

7. Remove the piston seal from the caliper cylinder bore. Check the piston and cylinder bore for wear and/or corrosion. Replace components as necessary.

To assemble:

8. Coat all components with clean brake fluid or lithium soap base glycol grease.
9. Install the piston seal and then the piston into the caliper cylinder bore. Seat the piston in the bore with your fingers.
10. Fit the boot into the groove in the cylinder bore and press in the set ring.
11. On FS17 types, install the main pin boots to the torque plate. Install the sub pin slide bushing into the torque plate.
12. On PD60 types, install the collar and dust boots into the caliper. Make sure they are firmly secured to the groove in the caliper. Install the bushing into the boots so that it is firmly set in the boot groove.
13. Install the caliper and brake pads.
14. Install the wheels and lower the truck. Bleed the brakes and road test the vehicle.

4WD Vehicles

➧ See Figures 34, 35 and 36

1. Raise the front of the truck and support with safety stands. Remove the wheels.
2. Remove the caliper.
3. Carefully pry the dust boot set rings out of the caliper. Remove the dust boots.
4. Insert a piece of wood about ½ in. thick between the caliper pistons.

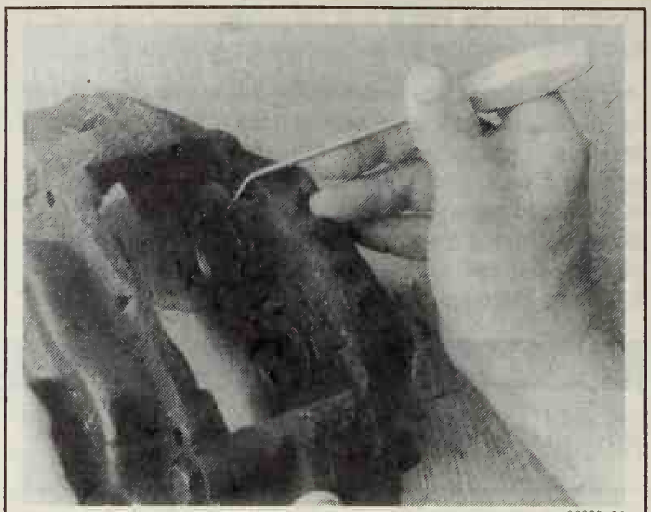


Fig. 34 Using a seal pick, remove the dust boot rings

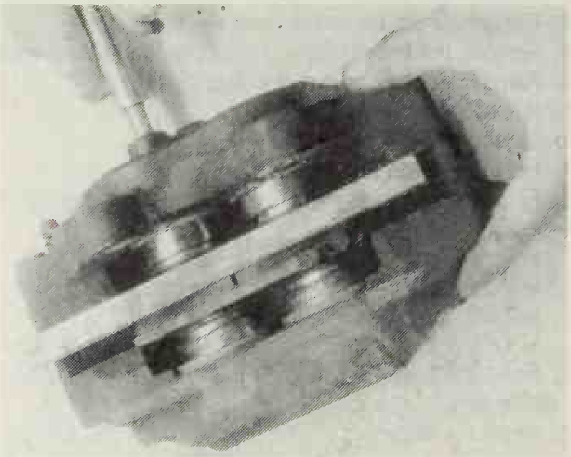


Fig. 35 Place a piece of wood between the pistons, then apply compressed air to force them out

5. Apply compressed air to the brake line union to force the piston out of its bore. Be careful; the piston will come out forcefully.

⁂CAUTION

Keep fingers away from the front of the piston during removal. Injury may occur when the piston comes out.

6. Remove the piston seals from the caliper cylinder bores. Check each piston and cylinder bore for wear and/or corrosion. Replace components as necessary.

⁂WARNING

Do not loosen the four bolts holding the two halves of the caliper together.

To assemble:

7. Coat all components with clean brake fluid or lithium soap based glycol grease.

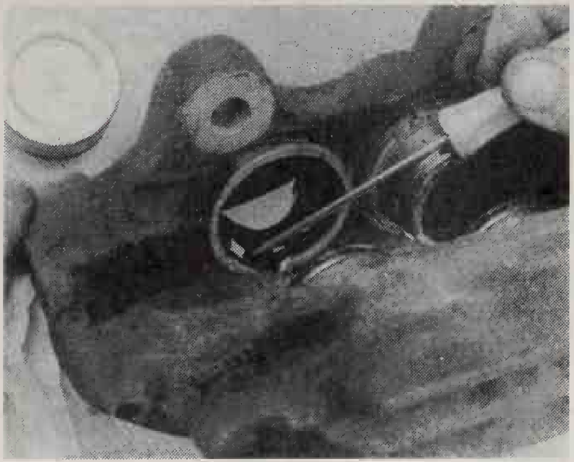


Fig. 36 Once the pistons are removed, use the seal pick to withdraw the piston seals

8. Install the piston seals then the pistons into the caliper cylinder bores. Seat the pistons in the bores with your fingers.
9. Fit the boots into the grooves in the cylinder bores and press in the set rings.
10. Install the caliper and brake pads.
11. Install the wheels and lower the truck. Bleed the brakes and road test the vehicle.

Brake Disc

REMOVAL & INSTALLATION

1. Disconnect the ABS speed sensor from the knuckle if equipped.
2. Remove the brake pads and the caliper.
3. Check the disc run-out at this point. Make a note of the results for use during installation. Refer to the inspection procedure.
4. Remove the grease cap from the hub. Remove the cotter pin and the castellated nut.
5. Remove the wheel hub with the brake rotor attached.
6. Perform the rotor inspection procedure.

To install:

7. Coat the hub oil seal lip with multi-purpose grease and install the disc/hub assembly.
8. Adjust the wheel bearing.
9. Using a dial indicator, measure the disc run-out. Check it against the specifications in the Brake Specifications chart and the figures noted earlier.

➡If the wheel bearing nut is improperly tightened, disc run-out will be affected.

10. Install the remainder of the components as outlined in the appropriate sections.
11. Bleed the brake system.
12. Road test the truck. Double check the wheel bearing preload.

INSPECTION

Examine the disc. If it is worn, warped or scored, it must be replaced. Check the thickness of the rotor against the specifications given in the Brake Specifications chart. If below specifications, replace it. Use a micrometer to measure the thickness. Because the allowable wear from new thickness to minimum thickness is only approx. 0.078 in. (2mm), resurfacing the discs is not recommended.

The disc run-out should be measured before the rotor is removed and again, after the rotor is installed. Use a dial indicator mounted on a stand to determine run-out. If run-out exceeds the maximum specification, replace the disc. Maximum runout is as follows:

- 2WD Pick-Up PD 60 brakes — 0.0035 in. (0.09mm)
- 2WD Pick-Up PD 66 brakes — 0.0047 in. (0.12mm)
- 2WD Pick-Up FS 17 or 18 brakes — 0.0035 in. (0.09mm)
- 4WD 1989-95 Pick-Up and 4Runner — 0.0035 in. (0.09mm)
- T100, Tacoma and 1996 4Runner — 0.0028 in. (0.07mm)
- Land Cruiser — 0.0059 in. (0.015mm)

➡Be sure that the wheel bearing nut is properly tightened. If it is not, an inaccurate run-out reading may be obtained. If different run-out readings are obtained with the same disc, between removal and installation, this is probably the cause.

REAR DRUM BRAKES

✲✲CAUTION

Brake shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

Brake Drum

REMOVAL & INSTALLATION

▸ See Figures 37, 38 and 39

1. Remove the hub cap (if used) and loosen the lug nuts. Release the parking brake.
2. Block the front wheels, raise the rear of the truck, and support it with jackstands.
3. Remove the rear wheels.

4. Unfasten the brake drum retaining screws, if used. Not all models have them.

5. Tap the drum lightly with a mallet in order to free it.

6. If the drum cannot be removed easily, insert a screwdriver into the hole in the backing plate and hold the automatic adjusting lever away from the adjusting bolt. Using another flat-bladed tool, relieve the brake shoe tension by turning the adjusting bolt clockwise. If the drum still will not come off, use a puller, but first make sure that the parking brake is fully released.

To install:

WARNING

Do not depress the brake pedal once the brake drum has been removed.

7. Inspect the brake drum for any wear or deterioration. Check the inside diameter of the drum with the Brake Specifications chart. Replace if necessary.

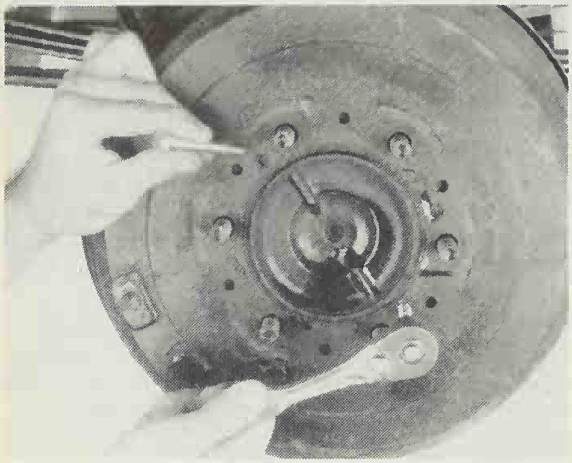

86829p23

Fig. 37 Bolts can be inserted into the holes as shown to aid in drum removal

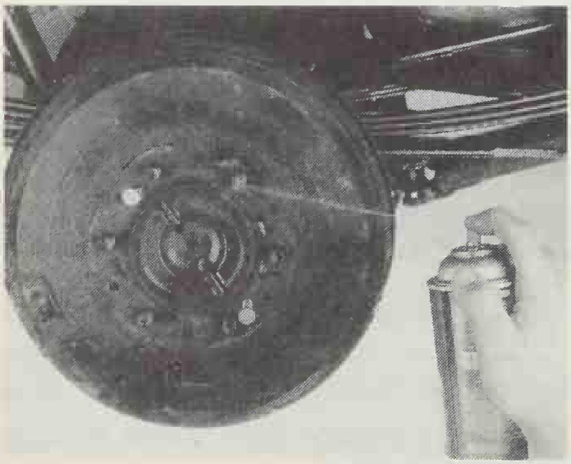

86829p24

Fig. 38 Lubricate the studs to help ease the drum from the hub

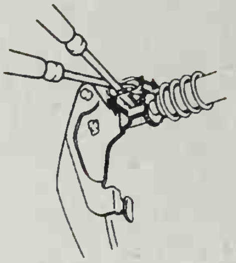

86829g36

Fig. 39 Hold the lever away from the bolt while rotating the adjuster bolt

8. To install the drum, simply place the drum on the axle and tighten the retaining screw, if used. Adjust the brakes.

9. Install the wheels and lower the truck. Road test the vehicle checking for correct function.

INSPECTION

➧ **See Figure 40**

1. Clean the drum.

2. Inspect the drum for scoring, cracks, grooves and out-of-roundness. Replace the drum or have it "turned" at a machine or brake specialist shop, as required. Light scoring may be removed by dressing the drum with fine emery cloth.

3. Measure the inside diameter of the drum. A tool called a H-gauge caliper is used. See the Brake Specifications chart for your vehicle.

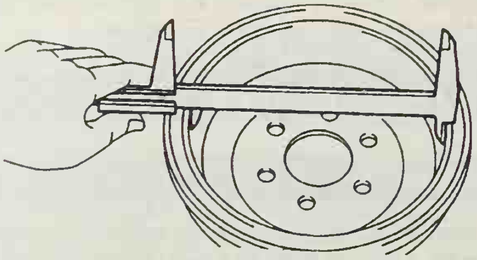

86829g38

Fig. 40 Use a H-gauge caliper to measure the inside diameter of a brake drum

Brake Shoes

INSPECTION

The brake shoes can be inspected without removing the brake drum if necessary. Remove the inspection hole plug in the backing plate. Check the shoe lining thickness through the hole. If they seem to be less than the minimum of 0.039 in. (1.0mm), replace the shoes.

REMOVAL & INSTALLATION

➡Drum brakes require the use of two common brake tools to make the job easier. A brake spring wrench and a spring removing tool can be purchased at almost any automotive outlet for low cost. These are two of the handiest special tools you can own; they can generally be used on any vehicle with drum brakes.

2WD Vehicles

LEADING-TRAILING BRAKES

➧ See Figures 41, 42, 43, 44, 45, 46 and 47

1. Raise the rear of the truck and support it with jackstands. Remove the wheels.
2. Remove the brake drum.
3. Using a brake tool, remove the return spring.
4. Remove the front shoe hold-down spring and pin. Remove the front shoe with the anchor spring.
5. Remove the hold-down spring and pin and pull out the rear shoe.
6. Remove the parking brake cable from the lever.
7. Remove the E-clip and spread the C-washer to remove it from the parking brake lever. Remove the adjusting lever spring.

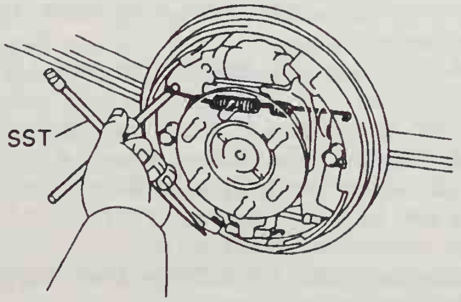


Fig. 41 Special tools are available to remove the return spring

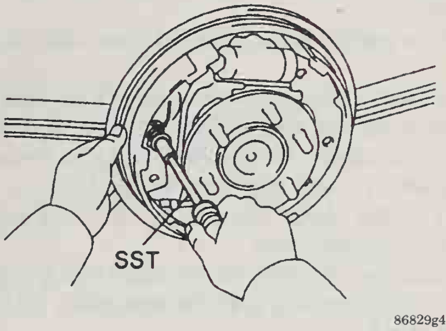


Fig. 42 Push in the special tool to remove the hold-down spring and retainers

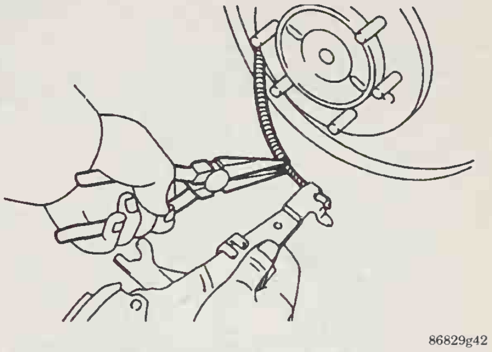


Fig. 43 Separate the parking cable from the lever, then remove the shoe

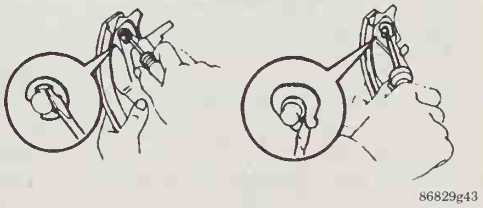


Fig. 44 Remove the E-clip and spread the C-washer to remove it from the parking brake lever

To install:

8. Apply high temperature grease to the contact surface of the brake backing plate and to the threads and end of the adjuster bolt.

9. Pull the parking brake cable out, then attach it to the lever.

10. Connect the strut and return spring to the lever.

11. Position the rear shoe so that the upper end of the shoe is in the wheel cylinder and the lower end is in the anchor plate. Install the pin and hold-down spring.

12. Connect the anchor spring to the rear shoe and then stretch it onto the front shoe.

13. Position the front shoe so the upper end is in the wheel cylinder and the lower end is in the strut. Install the pin and hold-down spring.

14. Install the return spring.

15. Check that the adjuster bolt turns while pulling up on the brake lever. Adjust the strut to the shortest possible length and install the brake drum. Pull the parking brake lever (inside the truck) out until the clicks stop.

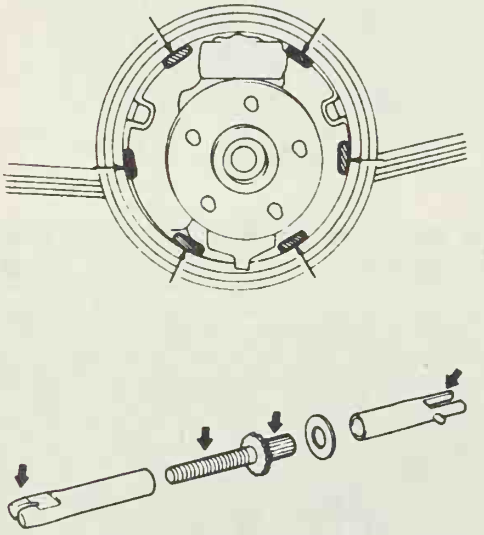


Fig. 45 Apply high-temperature grease to the areas indicated

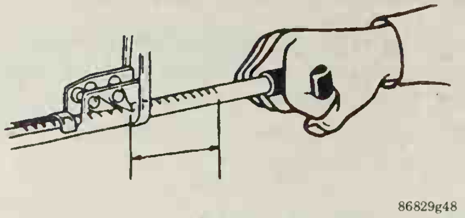


Fig. 46 Pull the parking brake lever all the way up until the clicking is no longer heard

16. Remove the brake drum and check that the difference between the inner brake drum diameter and the outer brake shoe diameter is no more than 0.024 in. (0.6mm). Adjust or replace parts as needed.

17. Install the brake drum. Install the wheels and lower the truck. Bleed the brakes and road test the vehicle.

DUO-SERVO BRAKES

➧ See Figure 48

1. Raise the rear of the truck and support it with jackstands. Remove the wheels.

2. Remove the brake drum.

3. Using a brake tool, remove the 2 return springs.

4. Push up on the brake adjusting lever and remove the cable, shoe guide plate and cable guide. Disconnect the spring at the brake lever and remove them both.

5. Using needle-nose pliers, remove the 2 tension springs.

6. Using a brake tool, remove the shoe hold-down springs and pins.

7. Remove the shoes, the adjuster and the strut.

8. Pull the parking brake cable out, then disconnect it at the parking brake lever.

To install:

9. Apply high-temperature grease to the contact surface of the brake backing plate.

10. Pull the parking brake cable out and attach it to the lever.

11. Position the rear shoe so that its upper end is in the piston rod. Install the shoe hold-down spring and pin.

12. Install the strut with the spring to the rear. Position the front shoe over the strut so that the upper end is in the piston rod. Install the hold-down spring and pin.

13. Grease the threads and end of the brake adjuster and install it between the brake shoes.

14. Install the shoe guide plate and the adjusting cable. Install the front return spring and then install the rear one.

15. While holding the tension spring against the rear shoe, hook the cable into the adjusting lever and install the lever. Pull the adjusting cable backward and release it; the adjusting bolt should turn.

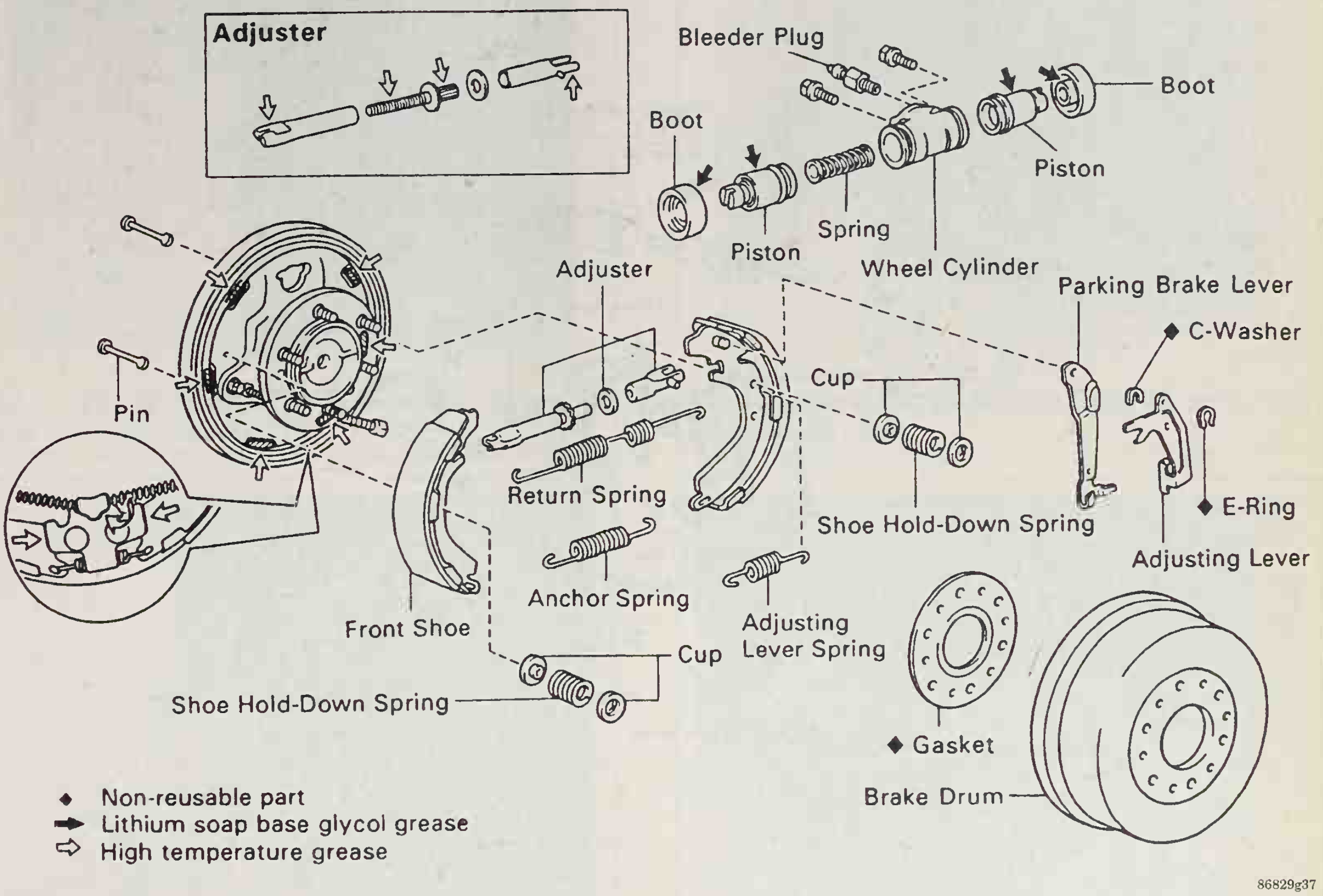

Adjuster
Bleeder Plug
Boot
Boot
Piston
Spring
Piston
Wheel Cylinder
Adjuster
Parking Brake Lever
◆ C-Washer
Pin
Cup
Return Spring
Shoe Hold-Down Spring
◆ E-Ring
Adjusting Lever
Anchor Spring
Adjusting Lever Spring
Front Shoe
Cup
Shoe Hold-Down Spring
◆ Gasket
Brake Drum
◆ Non-reusable part
➡ Lithium soap base glycol grease
⇨ High temperature grease
86829g37

Fig. 47 Exploded view of the 2WD rear brake components with leading-trailing brakes

16. Adjust the strut to the shortest possible length and install the brake drum. Turn the drum in the reverse direction and have an assistant step on the brake pedal. Continue this process until the clicking noise is no longer heard.

17. Remove the brake drum and check that the difference between the inner brake drum diameter and the outer brake shoe diameter is no more than 0.024 in. (0.6mm). Adjust or replace parts as needed.

18. Install the brake drum. Install the wheels and lower the truck. Bleed the brakes and road test the vehicle.

4WD Vehicles

➧ See Figures 49, 50, 51, 52, 53, 54, 55, 56, 57, 58 and 59

1. Raise the rear of the truck and support it with jackstands. Remove the wheels.
2. Remove the brake drum.
3. Remove the tension spring.
4. Remove the rear shoe hold-down spring and pin and then lift out the rear shoe and anchor spring.
5. Remove the front shoe hold-down spring and pin. Disconnect the parking brake cable at the bellcrank.
6. Remove the automatic adjusting lever and parking brake lever as follows:
    a. Remove the E-clip.
    b. Remove the automatic adjusting lever.
    c. Spread and remove the C-washer.
    d. Remove the parking brake lever.
7. Remove the front shoe with the strut. Disconnect the other parking brake cable.
8. Disconnect the adjusting lever spring and remove the adjuster from the front shoe.

To install:

9. Assemble and install the parking brake bellcrank as follows:
    a. Apply grease to the rotating parts of the bellcrank.
    b. Install the parking brake bellcrank to the bellcrank bracket.
    c. Install the pin with a new C-clip and tighten it.
    d. Install the bellcrank boot to the parking brake bracket.
    e. Install the parking brake bellcrank and dust cover on the backing plate.

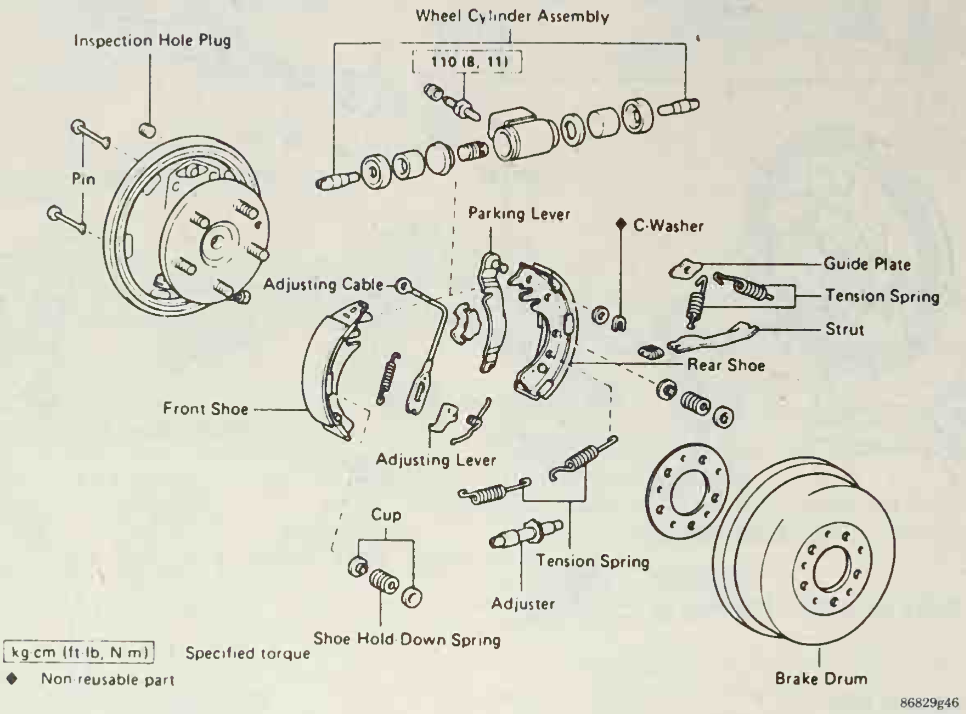

Wheel Cylinder Assembly
Inspection Hole Plug
110 (8, 11)
Pin
Parking Lever
◆ C-Washer
Guide Plate
Tension Spring
Strut
Adjusting Cable
Rear Shoe
Front Shoe
Adjusting Lever
Cup
Tension Spring
Adjuster
Shoe Hold-Down Spring
kg-cm (ft-lb, N-m) Specified torque
◆ Non-reusable part
Brake Drum
86829g46

Fig. 48 Exploded view of the 2WD rear brake components with duo-servo brakes

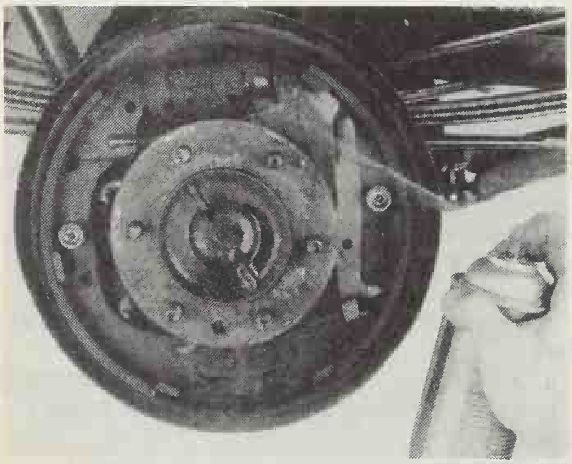


Fig. 49 Saturate the brake components using a commercially available brake cleaner

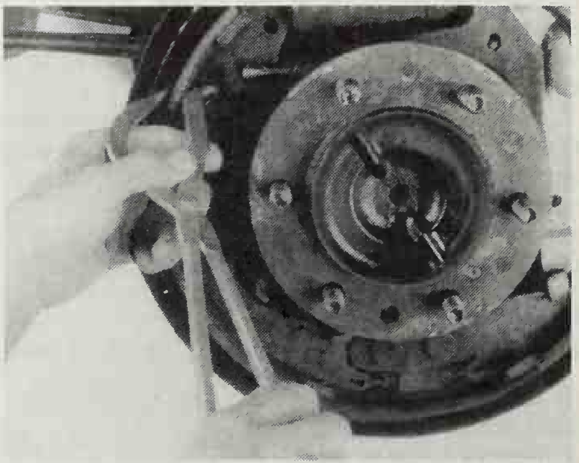
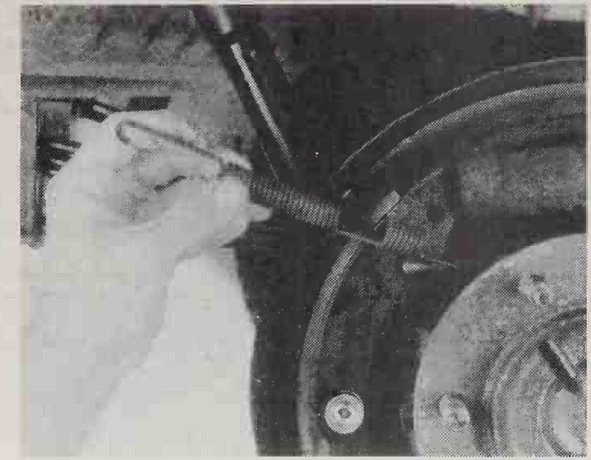
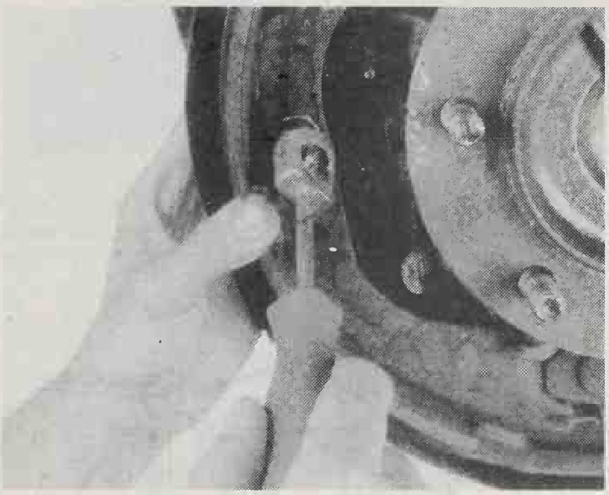


Fig. 50 A special tool is available to remove the return spring



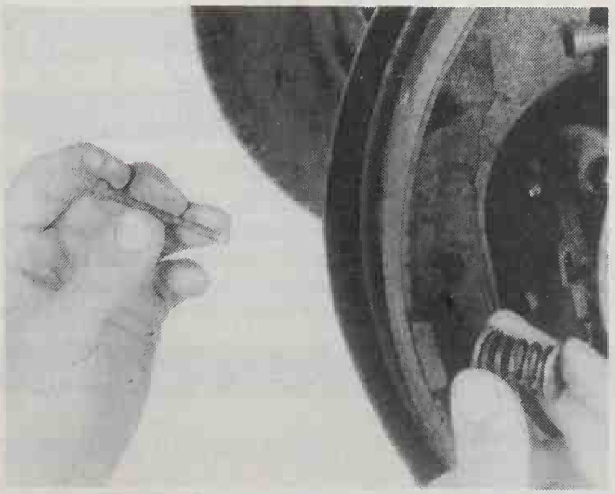
86829p27

Fig. 51 After the return spring is disengaged, remove it from the brake assembly



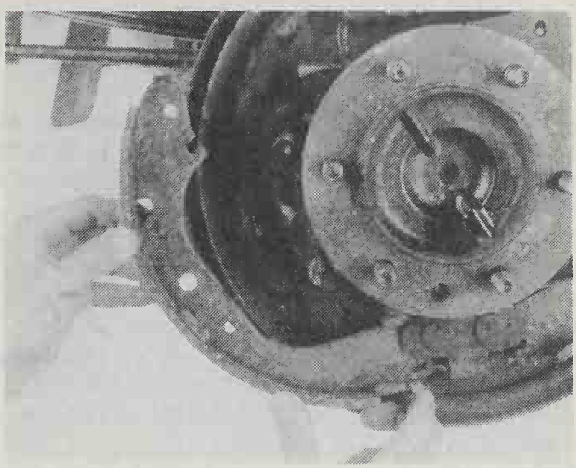
86829p28

Fig. 52 Push inwards then twist . . .



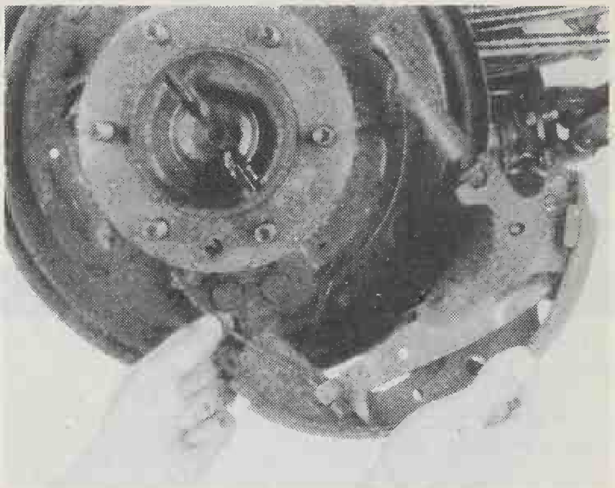
86829p29

Fig. 53 . . . then remove the pin and hold-down spring



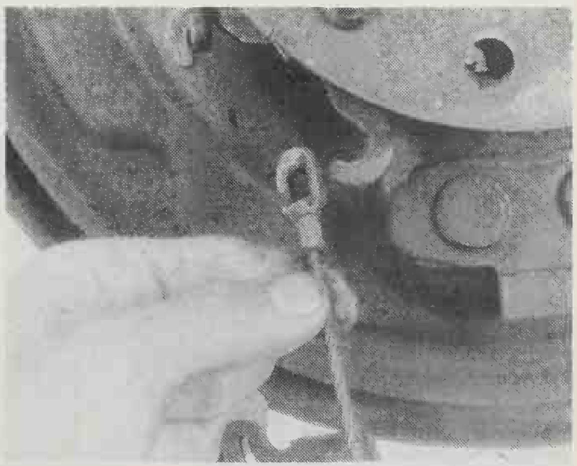
86829p30

Fig. 54 Lower the shoe, then disconnect the spring that attaches both shoes



86829p31

Fig. 55 Remove the other side . . .



86829p32

Fig. 56 . . . then, disconnect the cable from the bellcrank

10. Apply high-temperature grease to the brake backing plate contact surfaces and the threads of the adjuster.

11. Position the parking brake lever and the automatic adjuster. Use new clips and tighten the C-clip.

12. Connect the parking brake cable to the shoe lever. Attach the other side of the cable to the bellcrank. Position the front shoe so the upper end is in the piston rod and install the hold-down spring and pin.

13. Connect the anchor spring to the front shoe, then stretch it onto the rear shoe. Position the rear shoe and install the hold-down spring and pin.

14. Install the tension spring. Lightly pull the bellcrank in direction **A** until there is no slack at **B**. Turn the adjusting bolt so that **C** will be 0.02-0.03 in. (0.4-0.8mm) on all models excluding 1996 4Runner which is 0.016-0.031 in. (0.4-0.8mm). Lock the adjusting bolt with the locknut.

15. Connect the parking brake cable to the bellcrank and install the tension spring.

16. Check that the parking brake lever (inside the truck) travel is correct and that the adjuster turns while pulling the lever.

17. Turn the adjuster to the shortest possible length and install the brake drum. Pull the parking brake lever out until the clicks stop.

18. Remove the brake drum and check that the difference between the inner brake drum diameter and the outer brake shoe diameter is no more than 0.024 in. (0.6mm).

19. Install the brake drum. Install the wheels and lower the truck. Bleed the brakes and road test the vehicle.

Wheel Cylinders

REMOVAL & INSTALLATION

See Figures 60, 61 and 62

1. Remove the brake drums and shoes.
2. Working from behind the backing plate, disconnect the hydraulic line from the wheel cylinder. Plug the line to prevent fluid loss.

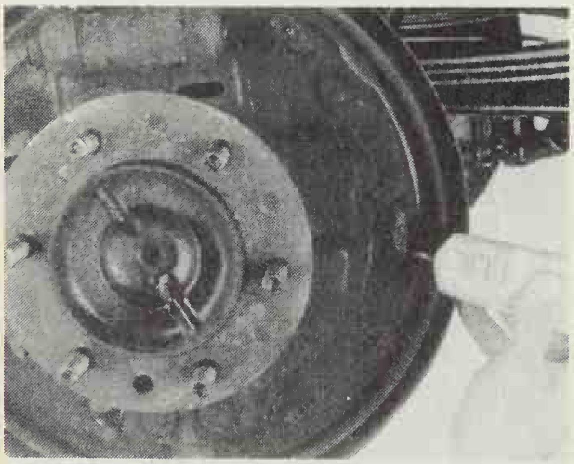
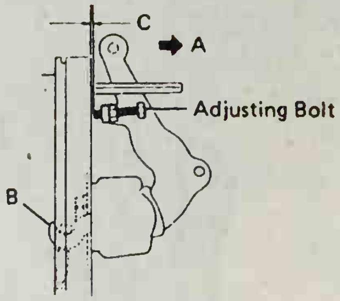
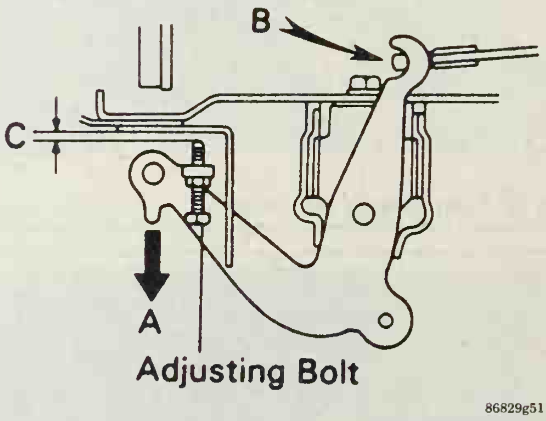

86829p33

Fig. 57 Apply high-temperature grease to the brake backing plate and the threads of the adjuster



86829g50

Fig. 58 Bellcrank adjusting points — except Land Cruiser



86829g51

Fig. 59 Bellcrank adjustment points on the Land Cruiser

To install:

3. Position the cylinder and install the bolts; tighten them to 7 ft. lbs. (10 Nm).
4. Connect the brake line, tightening it to 11 ft. lbs. (15 Nm).
5. Install the shoes and drums.
6. Bleed the brake system.
7. Unfasten the bolts retaining the wheel cylinder and withdraw the cylinder.

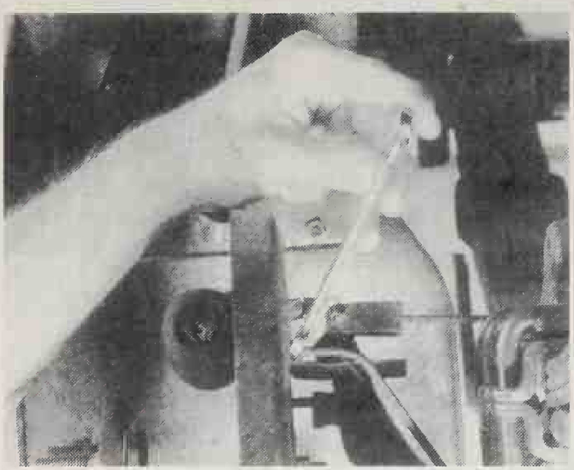


Fig. 60 Using a line wrench, loosen and disconnect the brake line

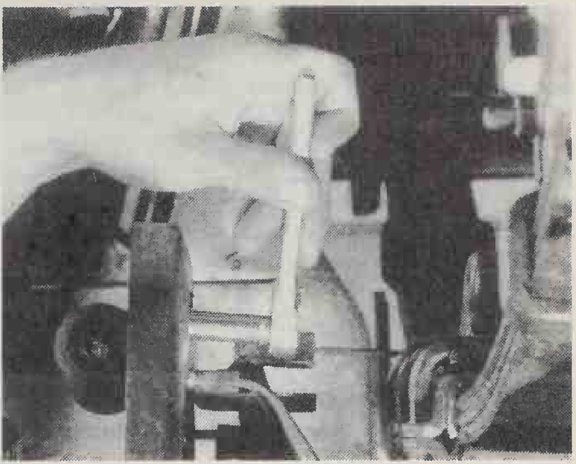


Fig. 61 Remove the bolts securing the wheel cylinder to the backing plate . . .

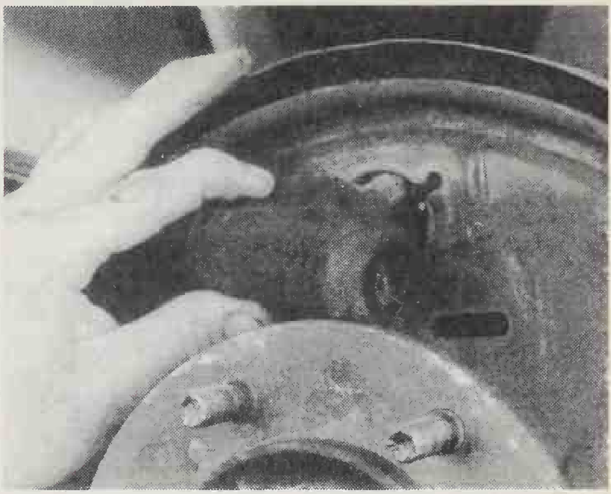


Fig. 62 . . . then pull it from its mount

REAR DISC BRAKES

⁂CAUTION

Brake pads may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

Brake Pads

REMOVAL & INSTALLATION

➧ See Figures 63, 64, 65 and 66

1. Loosen the lug nuts.
2. Raise and support the rear of the vehicle.
3. Remove the wheels.
4. Inspect the pad thickness through the caliper hole, then replace the pads if not within specifications, 0.039 in. (1.0mm).
5. Remove the brake caliper as follows:
    a. Remove the sliding main pin and sliding sub pin.
    b. Remove the caliper and suspend it so the hoses are not stretched. You can use a piece of wire for this. Do not disconnect the hoses.
6. Remove the brake pads, anti-squeal shim, support plate and wear indicators. The support plates can be used again provided they have sufficient rebound, no deformation, cracks or wear. Clean them of any rust, dirt and foreign particles.

To install:

7. Check the thickness and runout. Standard thickness should be 0.394 in. (10.0mm) and runout maximum is 0.0059 in. (0.15mm).

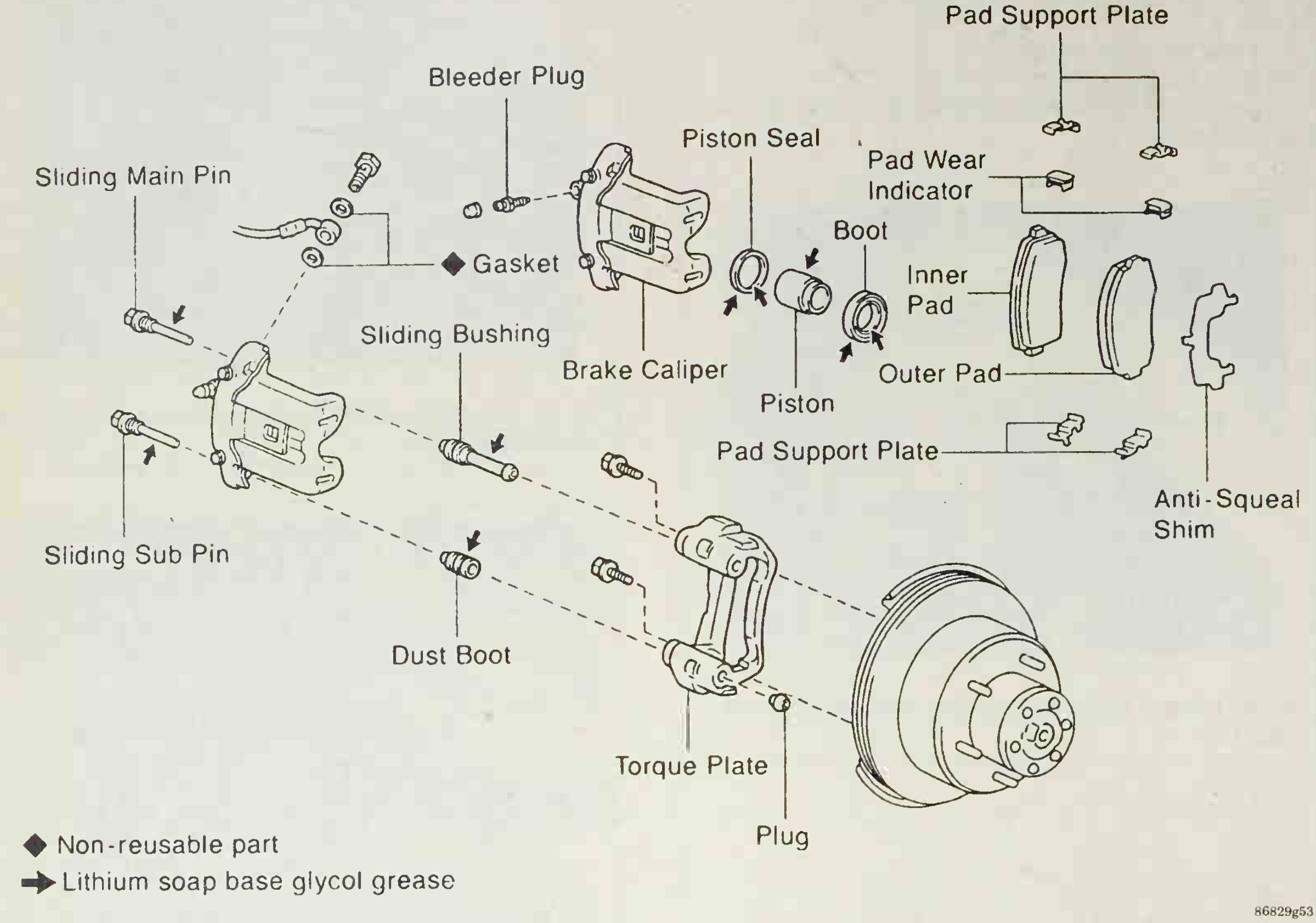

Pad Support Plate
Bleeder Plug
Piston Seal
Pad Wear Indicator
Sliding Main Pin
Boot
◆ Gasket
Inner Pad
Sliding Bushing
Brake Caliper
Outer Pad
Piston
Pad Support Plate
Anti-Squeal Shim
Sliding Sub Pin
Dust Boot
Torque Plate
Plug
◆ Non-reusable part
➡ Lithium soap base glycol grease
86829g53

Fig. 63 Exploded view of the rear disc brakes — Land Cruiser

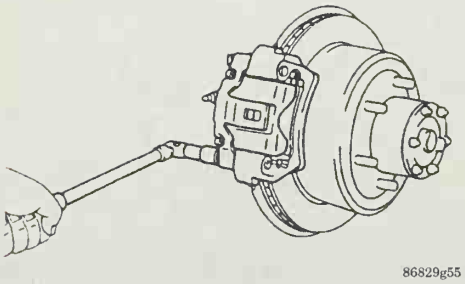


Fig. 64 Remove the bolts securing the caliper to the rotor

8. Install the pad support plates.
9. Install the pad wear indicators plate to each of the pads.
10. Place the anti-squeal shims into position on the outer pad.
11. Install the pads so that the wear indicator plate is facing upwards.
12. Draw out a small amount of brake fluid from the reservoir with a syringe.
13. Press in the piston with a hammer handle or a C-clamp.
14. Install the caliper carefully so the boot is not wedged. Install and tighten the sliding main pin and sub pin to 65 ft. lbs. (88 Nm).
15. Install the wheel.
16. Check the fluid level, top off if necessary.
17. Bleed the brake system.
18. Lower the vehicle, tighten the lug nuts.
19. Before driving the vehicle press the brake pedal several times.

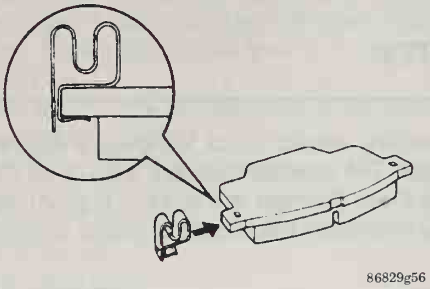


Fig. 65 The wear indicators slide over the end of the pads as shown

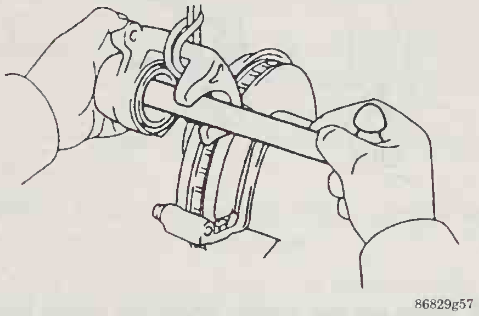


Fig. 66 Seat the piston with a hammer handle or a C-clamp

INSPECTION

Using a ruler, measure the pad lining thickness. Standard thickness is 0.374 in. (9.5mm) and minimum thickness is 0.039 in. (1.0mm). Replace the pads if the thickness is not at the minimum or less, or if the pad has severe and uneven wear.

Brake Caliper

REMOVAL & INSTALLATION

1. Loosen the lug nuts.
2. Raise and support the rear of the vehicle.
3. Remove the rear wheels.
4. Remove the sliding main pin and sliding sub pin.
5. Disconnect and plug the hoses from the caliper assembly.
6. Remove the mounting bolts and the caliper from the vehicle.

To install:

7. Draw out a small amount of brake fluid from the reservoir with a syringe.
8. Attach the brake hoses to the caliper.
9. Press in the piston with a hammer handle or C-clamp.
10. Install the caliper carefully so the boot is not wedged. Install and tighten the sliding main pin and sub pin to 65 ft. lbs. (88 Nm).
11. Install the wheel.
12. Check the fluid level, top off if necessary.
13. Bleed the brake system.
14. Lower the vehicle, tighten the lug nuts.
15. Before driving the vehicle press the brake pedal several times.

OVERHAUL

1. Remove the caliper.
2. Using a flat-bladed tool, remove the cylinder boot from the caliper.
3. Place a piece of cloth or similar article (lint-free) between the piston and caliper.
4. Use compressed air to remove the piston from the caliper. Keep your hands free from the piston exit area.

✲✲CAUTION

Brake pads may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air. Avoid inhaling any dust from brake surfaces. When cleaning brakes, use commercially available brake cleaning fluids.

5. With a seal pick, remove the piston seal from the cylinder.
6. Tap out the boot and sliding bushing. A tapped-ended drift and hammer will do well.

To assemble:

7. Coat all components with clean brake fluid or lithium soap based glycol grease.
8. Install the piston seal, then the piston into the caliper cylinder bore. Seat the piston in the bore with your fingers.
9. Fit the boot into the groove in the cylinder bore and press in the set ring.
10. Install the caliper and brake pads.
11. Install the wheels and lower the truck.
12. Bleed the brake system.
13. Before driving the vehicle press the brake pedal several times.

Brake Disc

REMOVAL & INSTALLATION

1. Raise and support the vehicle.
2. Remove the rear wheels.
3. Disconnect the ABS speed sensor.

4. Remove the caliper.
5. Install the hub nuts temporarily to measure the disc runout and thickness. If not within specifications of inspection, replace the disc.
6. Place matchmarks on the disc and rear hub, then remove the disc.

➡If the disc cannot be removed easily, turn the shoe adjuster until the wheel turns freely.

To install:

7. Install the disc on the hub.
8. Install the caliper.
9. Attach the ABS speed sensor.
10. Install the wheels, hand-tighten the lugnuts.
11. Lower the vehicle, tighten the lugnuts.
12. Before driving the vehicle press the brake pedal several times.

INSPECTION

When deciding weather or not to replace a disc, measure the thickness. The standard thickness is 0.709 in. (18.0mm) and the minimum thickness is 0.630 in. (16.0mm). Measure the disc runout, maximum specification is 0.0059 in. (0.15mm).

PARKING BRAKE

Brake Lever

ADJUSTMENT

Except Land Cruiser

➧ See Figures 67, 68 and 69

1. Pull the parking brake lever all the way out (or up) and count the number of clicks to the end of travel. On 2WD ½ ton vehicles should have 12-18 clicks; 1-ton, 2WD vehicles and all 4WD vehicles should have 11-17 clicks. On 1989-95 4Runner check for 13-19 clicks and 1996 4Runner 7-9 clicks. If the parking brake lever is not within these ranges, adjust it.
2. Under the truck on 2WD models, there is an equalizer bar where the 2 cables come together. Tighten or loosen the adjusting nut until the lever travel is within the proper range. Check that the rear brakes are not dragging.
3. Under the truck on 4WD models, tighten the bellcrank stopper screw until the play in the rear brake links becomes zero, then loosen the screw 1 turn. Tighten the locknut.
4. Tighten one of the adjusting nuts on the intermediate lever while loosening the other one until the lever travel is correct. Tighten the adjusting nuts.

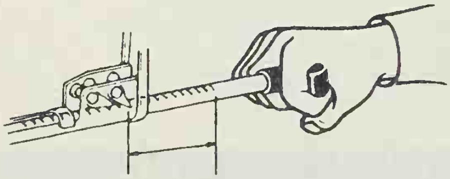


Fig. 67 Pull the lever until the correct amount of clicks are heard and then stop

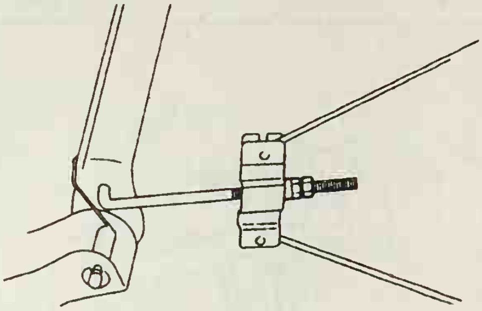


Fig. 68 There are two cables which are joined by an equalizer, the lock and adjusting nuts are located here

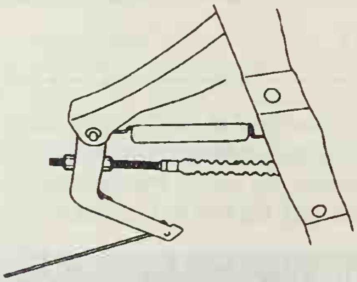


Fig. 69 On 4WD models, tighten the bellcrank stopper screw until the play in the rear brake links becomes zero, then loosen the screw 1 turn

5. After adjustment, check that the bellcrank stopper screw is touching the back of the brake backing plate.
6. Recheck the parking brake travel.

Land Cruiser

➧ **See Figure 70**

1. Pull the parking brake lever all the way out (or up) and count the number of clicks to the end of travel. There should be 7-9 clicks. If the parking brake lever is not within these ranges, adjust it.
2. Before adjusting the parking brake, make certain the rear brakes are correctly adjusted.
3. Remove the parking brake lever cover or rear console box.
4. Loosen the locknut, then turn the adjusting nut until the lever travel is correct.
5. Tighten the locknut.
6. Install the parking brake cover or rear console box.

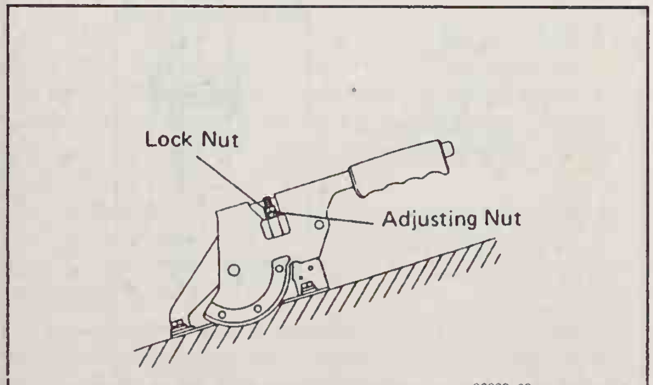


Fig. 70 On Land Cruisers the parking brake cables can be adjusted at the lever

Brake Shoes

REMOVAL & INSTALLATION

1. Loosen the rear wheel lug nuts.
2. Raise and support the rear of the vehicle.
3. Remove the rear wheels.
4. Remove the mounting bolts, then the disc brake caliper.
5. Suspend the disc brake caliper securely with a piece of wire. Be sure not to stretch or damage the hose.
6. Place matchmarks on the rotor and the rear hub. Remove the disc.

➡If the rotor cannot be removed easily, turn the shoe adjuster until the wheel turns freely.

7. Using a pair of pliers, remove the tension spring.
8. Remove the shoe return springs along with the shoe strut with spring.
9. Slide out the rear shoe, then remove the shoe and adjuster.
10. Remove the lower side tension spring.
11. Remove the shoe hold-down spring cups, spring and pin.
12. Slide out the front shoe. Disconnect the parking brake cable from the parking brake shoe lever.
13. Remove the shoe hold-down spring cups, spring and pin.
14. If necessary, remove and disassemble the parking brake bellcrank assembly as follows:
    a. Using a flat-bladed tool, remove the C-washer.
    b. Remove the pin, then separate the parking brake cable from the bellcrank.
    c. Remove the clip. Next remove the pin and clip, then disconnect the cable.
    d. Remove the tension spring. Unbolt the parking bellcrank assembly.
    e. Remove the boot from the bellcrank bracket. Using a flat-bladed tool, remove the C-washer and pin.
    f. Remove the parking bellcrank from the bellcrank bracket.

To install:

15. Assemble and install the parking brake bellcrank as follows:
    a. Apply grease to the rotating parts of the bellcrank.
    b. Install the parking brake bellcrank to the bellcrank bracket.
    c. Install the pin with a new C-clip and tighten it.
    d. Install the bellcrank boot to the parking brake bracket.
    e. Install the parking brake bellcrank and dust cover on the backing plate.
16. Apply high-temperature grease to the brake backing plate and the threads of the adjuster.
17. Position the parking brake lever and the automatic adjuster. Use new clips and tighten the C-clip.
18. Connect the parking brake cable to the front shoe lever. Connect the other side of the cable to the bellcrank. Position the front shoe so the upper end is in the piston rod and install the hold-down spring and pin.
19. Connect the anchor spring to the front shoe and then stretch it onto the rear shoe. Position the rear shoe and install the hold-down spring and pin.
20. Install the tension spring.
21. Install the strut with spring facing rearward.
22. Install the front shoe return springs and then the rear spring.
23. Install the brake disc.
24. Connect the parking brake cable to the bellcrank assembly with the pin, wave clip and clip.
25. Adjust the brake shoe clearance. Turn the adjuster and expand the shoes until the disc locks. Return the adjuster 8 notches.
26. If necessary adjust the bellcrank as follows:
    a. Pull the bellcrank until all the play in the interior linkage is taken up.
    b. Screw in the bellcrank adjusting bolt to where it contacts on the dust seal.
    c. Loosen it one turn, then lock it at that position with the locknut. Install the bellcrank spring.
27. Install the rear brake disc assembly, tighten the mounting bolts to 76 ft. lbs. (103 Nm).
28. Install the rear wheels.
29. Bleed the brakes. Pump the brake pedal several times, then road test the vehicle.

INSPECTION

Shoe Thickness

See Figure 71

Using a ruler, measure the thickness of the shoe lining. The standard thickness is 0.157 in. (4.0mm) and the minimum thickness is 0.039 in. (1.0mm). If the lining thickness is not within minimum thickness or less, or if there is an extremely uneven wear, replace the shoes.

Rotor Inside Diameter

See Figure 72

Using a H-gauge caliper, measure the inside diameter of the rotor. Standard inside measurement is 9.06 in. (230mm) and maximum measurement is 9.09 in. (231mm). Replace the rotor if the inside diameter is at the maximum value or more. Replace or have a machine shop grind the rotor with a lathe if it has been scored or is worn badly.

Shoe and Lever Clearance

See Figure 73

Using a feeler gauge, measure the clearance between the parking shoe and the lever. Standard distance should be 0.0138 in. (0.35mm). If the clearance is not within the the specification, replace the shim with one of the correct size. The sizes available are 0.012 in. (0.3mm), 0.024 in. (0.6mm) and 0.035 in. (0.9mm). If necessary replace the shim, remove the parking brake lever, then install the correct size. Install the parking break lever with a new C-washer. Remeasure the clearance.

ADJUSTMENTS

Parking Brake Shoe Clearance

1. Temporarily install the hub nuts.

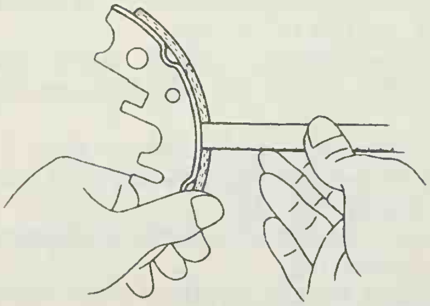


Fig. 71 Using a ruler, measure the thickness of the shoe lining

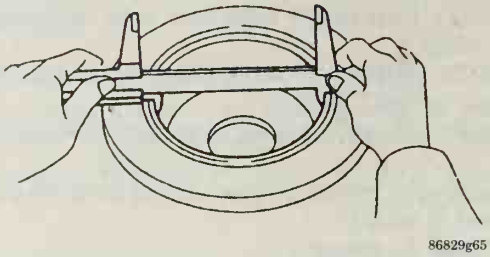


Fig. 72 Using a H-gauge caliper, measure the inside diameter of the rotor

2. Remove the hole plug.
3. Turn the adjuster, then expand the shoes until the rotor locks.
4. Return the adjuster 8 notches.
5. Install the hole plug.

Bellcrank

1. Pull the bellcrank until all the play in the interior linkage is taken up.
2. Screw in the bellcrank adjusting bolt to where it contacts on the dust seal.
3. Loosen it in one turn, then lock it at that position with the locknut at 48 inch lbs. (5 Nm).
4. Install the bellcrank spring.

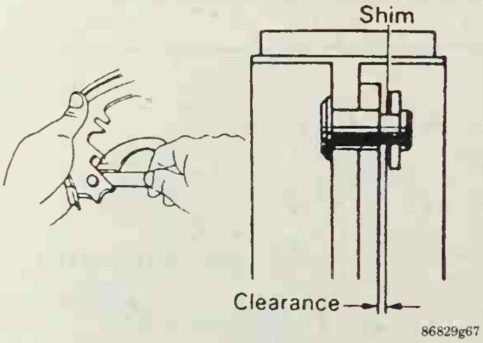


Fig. 73 Using a feeler gauge, measure the clearance between the parking shoe and the lever

REAR WHEEL ANTI-LOCK BRAKE SYSTEM

General Information

See Figure 74

The rear wheel anti-lock system found on Toyota trucks is designed to keep the rear wheels from locking under hard braking regardless of the load being carried. This function aids in keeping the vehicle from skidding sideways under hard braking with loss of directional stability.

Since the anti-lock system acts only on the rear wheels, it may be possible to lock the front wheels, causing them to skid; no steering response is possible if this happens.

The electro-hydraulic system employs one speed sensor in the differential housing. The speed signal is sent to the Electronic Control Unit (ECU) which controls the operation of the control solenoid within the actuator. The solenoid controls brake line pressure within the single line running to there are axle; the line branches to each wheel at the axle housing.

A significant difference in this system (from 4 wheel ABS) is that power steering fluid is circulated through the brake system actuator. The ABS control solenoid acts on the power steering fluid, not the brake fluid circuit. The power steering fluid acts as a control pressure circuit, moving pistons and valves within the actuator which control the brake fluid circuit. The power steering fluid and the brake fluid are kept completely separate within the systems; each fluid is kept within its normal system reservoir.

Use of the power steering fluid allows a supply of constantly pressurized fluid (from the power steering pump) and eliminates the need for larger, bulkier actuators with electric pumps and accumulators.

Diagnosis and Testing

PRECAUTIONS

- Certain components within the system are not intended to be serviced or repaired individually. Only those components with removal and installation procedures should be serviced.
- Do not use rubber hoses or other parts not specifically specified for the anti-lock system. When using repair kits, replace all parts included in the kit.
- Use only DOT 3 brake fluid from an unopened container.
- If any hydraulic component (either power steering or brake) is removed or replaced, it may be necessary to bleed the entire system.
- A clean repair area is essential. Always clean the reservoir and cap thoroughly before removing the cap. The slightest amount of dirt in the fluid may plug an orifice and impair the system function. Perform repairs after components have been thoroughly cleaned; use only denatured alcohol to clean components. Do not allow components to come into contact with any substance containing mineral oil; this includes used shop rags.
- The ECU is a microprocessor similar to other computer units in the vehicle. Insure that the ignition switch is **OFF** before removing or installing controller harnesses. Avoid static electricity discharge at or near the controller.
- If any arc welding is to be done on the vehicle, the ECU should be disconnected before welding operations begin.
- If the vehicle is to be baked after paint repairs, remove the ECU from the vehicle.

INSPECTION

If a malfunction occurs, the system will identify the problem and the computer will assign and store a fault code for the fault(s). The dashboard warning lamp will be illuminated to inform the driver that a fault has been found.

During diagnostics, the system will transmit the stored code(s) by flashing the dashboard warning lamp. If two or more codes are stored, they will be displayed from lowest number to highest, regardless of the order of occurrence. The system does not display the diagnostic codes while the vehicle is running.

Visual Inspection

Before diagnosing an apparent rear anti-lock problem, make absolutely certain that the normal braking system and power steering systems are in correct working order. Many common problems (dragging parking brake, seepage, etc.) will affect the ABS system. A visual check of specific system components may reveal problems creating an apparent ABS malfunction. Performing this inspection may reveal a simple failure, thus eliminating extended diagnostic time.

- Inspect the brake fluid level in the reservoir.
- Inspect lines, hoses, master cylinder assembly, brake calipers and cylinders for leakage. Inspect the power steering system and components for the same conditions.
- Visually check lines and hoses for excessive wear, heat damage, punctures, contact with other parts, missing clips or holders, blockage or crimping.
- Check the calipers or wheel cylinders for rust or corrosion. Check for proper sliding action if applicable.
- Check the caliper and wheel cylinder pistons for freedom of motion during application and release.
- Inspect the speed sensor for proper mounting and correct connection.
- Confirm the fault occurrence. Certain driver induced faults, such as not releasing the parking brake fully, will set a fault code and trigger the dash warning light. Excessive wheel spin on low-traction surfaces, high speed acceleration or riding the brake pedal may also set fault codes and trigger a warning lamp. These induced faults are not system failures but examples of vehicle performance outside the parameters of the control unit.
- Many system shut-downs are due to loss of sensor signals to or from the controller. The most common cause is not a failed sensor but a loose, corroded or dirty connector. Check harness and component connectors carefully.

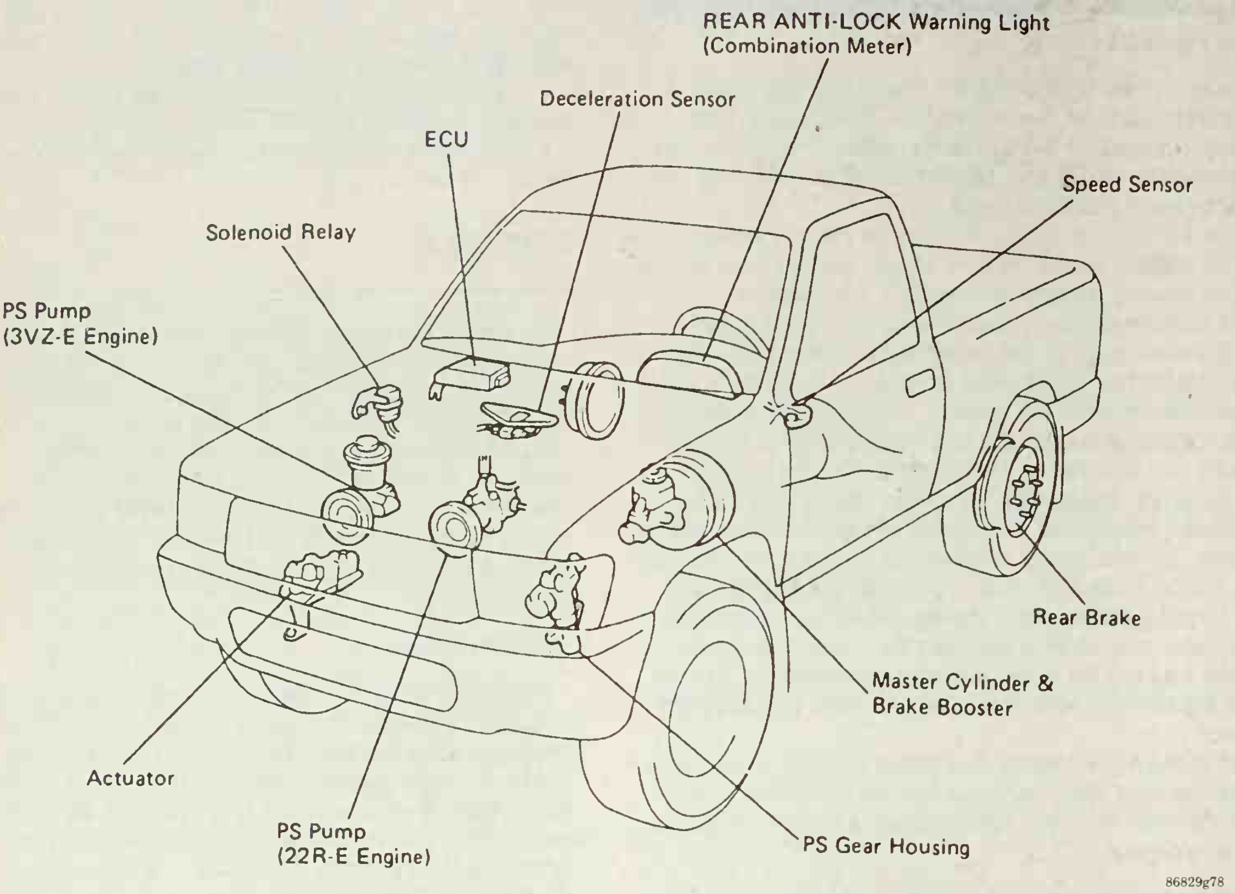

REAR ANTI-LOCK Warning Light
(Combination Meter)
Deceleration Sensor
ECU
Speed Sensor
Solenoid Relay
PS Pump
(3VZ-E Engine)
Rear Brake
Master Cylinder &
Brake Booster
Actuator
PS Pump
(22R-E Engine)
PS Gear Housing
86829g78

Fig. 74 Rear wheel anti-lock brake system component locations — Pick-Up shown

Reading Codes

See Figures 75, 76, 77 and 78

1. Turn the ignition switch **OFF**. Check battery condition; approximately 12 volts is required to operate the system.
2. Turn the ignition switch **ON** and check that the REAR ANTI-LOCK dashboard warning lamp comes on for 2 seconds. If the lamp does not come on, repair the fuse, bulb or wiring.
3. Use a jumper wire to attach terminals Tc and E1 of the Data Link Connector (DLC1). This is not the service connector. Turn the ignition **ON**.
4. If a fault code has been set, the dashboard warning lamp will begin to blink 4 seconds later. The number of flashes corresponds to the first digit of a 2-digit code; after a 1.5 second pause, the second digit is transmitted. If a second code is stored, it will be displayed after a 2.5 second pause. Once all codes have been displayed, the entire series will repeat after a 4 second pause. If no codes have been stored, the warning lamp will flash continuously every ½ second with no variation.
5. Turn the ignition switch **OFF**.

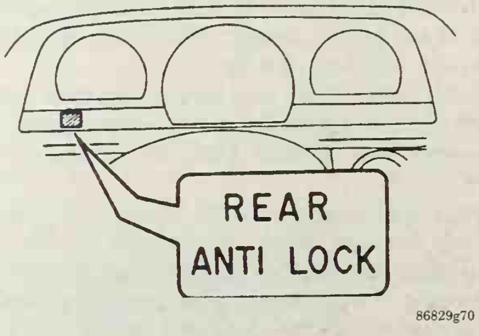

REAR
ANTI LOCK
86829g70

Fig. 75 The **REAR ANTI LOCK** warning lamp is located in the dash

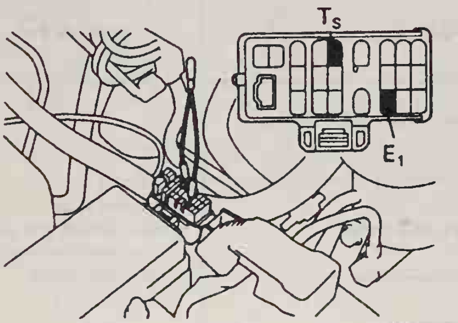


Fig. 76 Attach a jumper wire to the Ts and E1 terminals on the DLC1

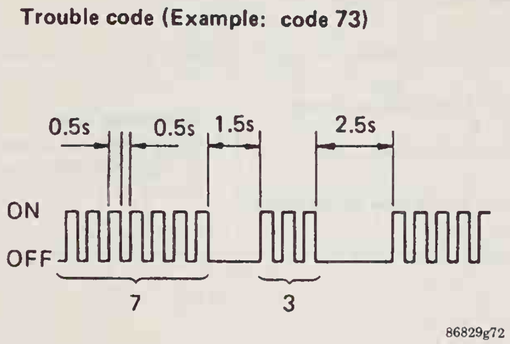


Fig. 77 Example of the code blinks on trouble code 73

6. Check or repair the system as indicated by the fault code.
7. After repairs are completed, clear the codes from the memory. If the battery is disconnected during repairs, the controller memory will be erased of all stored codes.
8. Remove the jumper wire and reattach the service connector at the actuator.

Clearing Codes

▶ See Figures 79, 80, 81 and 82

1. Detach the service connector at the actuator.
2. Use the jumper wire to connect terminals Tc and E1 of the data link connector (DLC1).
3. To clear the diagnostic trouble codes stored in the ECU by depressing the brake pedal 8 or more times within 3 seconds.
4. After the rapid pedal application, the dash warning lamp should display constant flashing, indicating a normal system. If codes are still displayed, make certain the repairs made to the system are correct. Also inspect the brake light switch at the brake pedal for any binding or sticking.
5. Once the codes are cleared, disconnect the jumper wire. The dash warning lamp should go out.

Speed Sensor

SYSTEM TEST

➡The following procedures require driving the vehicle while it is in the diagnostic mode. The anti-lock system will be disabled; only normal braking function will be available.

1. If working on a 4WD vehicle, make certain it is only in 2WD. Check the battery voltage with the engine off; voltage should be approximately 12 volts.
2. With the ignition switch **ON**, make certain the REAR ANTI-LOCK warning lamp comes on for about 3 seconds and then goes out. Turn the ignition switch **OFF**.
3. Using a 3-way jumper, connect terminals Tc, Ts and E1 at the Data Link Connector (DLC1).
4. Pull the parking brake on securely and start the engine without stepping on the brake pedal. Depressing the brake pedal will either void the test or cause the system to enter a different diagnostic mode.
5. The dashboard warning lamp should flash evenly about 4 times per second. If, instead, a code is flashed, repairs must be made and the code(s) cleared before continuing. If the light does not flash, check the parking brake switch, the DLC1 connector and the wiring to the ABS controller.
6. To check the sensor signal level, release the parking brake and drive the vehicle straight ahead at low speed. Once a speed of 2.5-3.7 mph (4-6 km) is reached, the warning lamp should turn off. Once the light has gone off, it should begin to blink as the vehicle leaves the speed range. This blinking is normal and indicates the speed sensor is operating correctly. If no blinking occurs, the system is defective.
7. Check the sensor signal change by driving the vehicle on the road. Once a speed of 25-31 mph (40-50 km) is achieved, the warning lamp should come on after a one second pause. As before, the lamp should blink evenly as the vehicle leaves the speed range; failure to blink indicates a system fault.

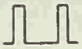
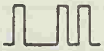
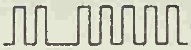
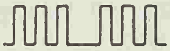
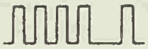
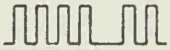
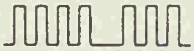
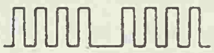
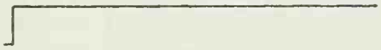
➡While the warning lamp is off, do not subject the vehicle to any shocks or impact such as shifting, acceleration, deceleration or road impact.

8. Stop the vehicle in a safe location and apply the parking brake fully. Read and record any stored codes which are displayed.
9. Turn the ignition switch **OFF**; remove the jumper wire from the DLC1 connector.

COMPONENT TEST

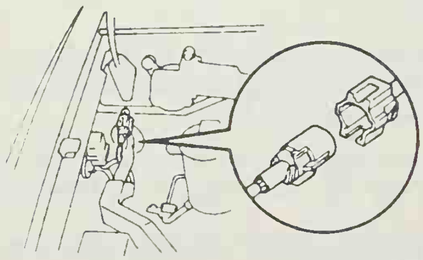
▶ See Figures 83, 84 and 85

1. Check the installation of the sensor. If the mounting bolt is loose, tighten it to 14 ft. lbs. (19 Nm).

Code No.	Light Pattern	Diagnosis	Trouble Part
11		Open circuit in solenoid relay circuit or solenoid circuit	• Solenoid • Solenoid relay • Wire harness and connector of solenoid and/or solenoid relay circuit
12		Short circuit in solenoid relay circuit	
25		Short circuit in solenoid circuit	
33		Open or short circuit in speed sensor circuit	• Speed sensor • Wire harness and connector of speed sensor circuit
41		Low battery positive voltage (9.5 V or lower)	• Battery
42		Abnormally high battery positive voltage (17 V or higher)	
43		Mechanical malfunction in deceleration sensor	• Deceleration sensor • Wire harness and connector of deceleration sensor circuit
44		Electrical malfunction in deceleration sensor circuit	
Always ON		Malfunction in ECU	• ECU

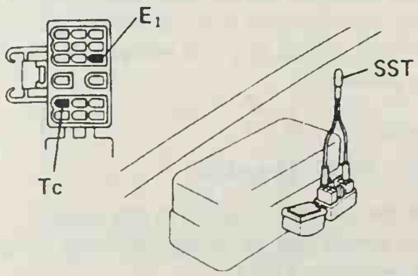
86829glm

Fig. 78 Diagnostic trouble codes for the rear wheel ABS system



86829g74

Fig. 79 Detach the service connector harness at the actuator



86829g75

Fig. 80 Use jumper wire or SST 09843-18020 to connect the terminals

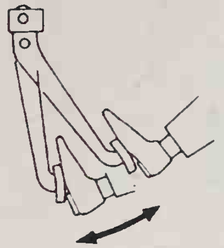


Fig. 81 Depress the brake pedal 8 or more times within 3 seconds to clear the codes

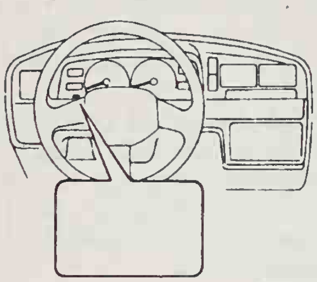


Fig. 82 To verify that your procedure was complete, the warning lamp should go out

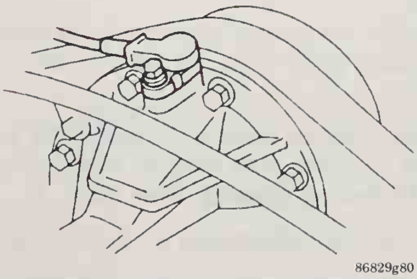


Fig. 83 Check that the speed sensor mounting bolt is tight

2. Disconnect the speed sensor harness from the ABS harness.

3. Measure the resistance with an ohmmeter between the terminals of the sensor connector. Correct resistance is 580-700 ohms. If the resistance is outside the specification, the sensor must be replaced.

4. Check that there is no continuity between each sensor terminal and the sensor body. If any continuity is found, the sensor is faulty.

5. Reconnect the speed sensor to the harness.

REMOVAL & INSTALLATION

➧ See Figure 86

The speed sensor is located in the rear differential housing. It transmits a small electrical signal to the ECU based on the rotational speed of the differential ring gear.

1. Unplug the sensor cable connector from the harness. If the sensor cable is held by brackets or clamps, release them.

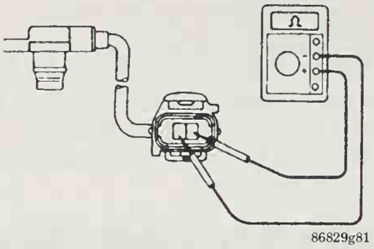


Fig. 84 The ohmmeter measures the resistance between the terminals of the sensor

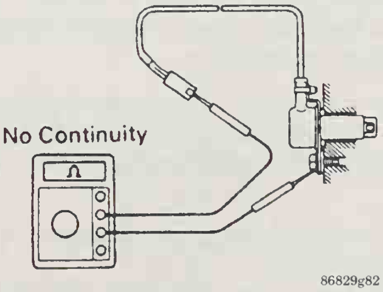


Fig. 85 Check that there is no continuity between each sensor terminal and the sensor body

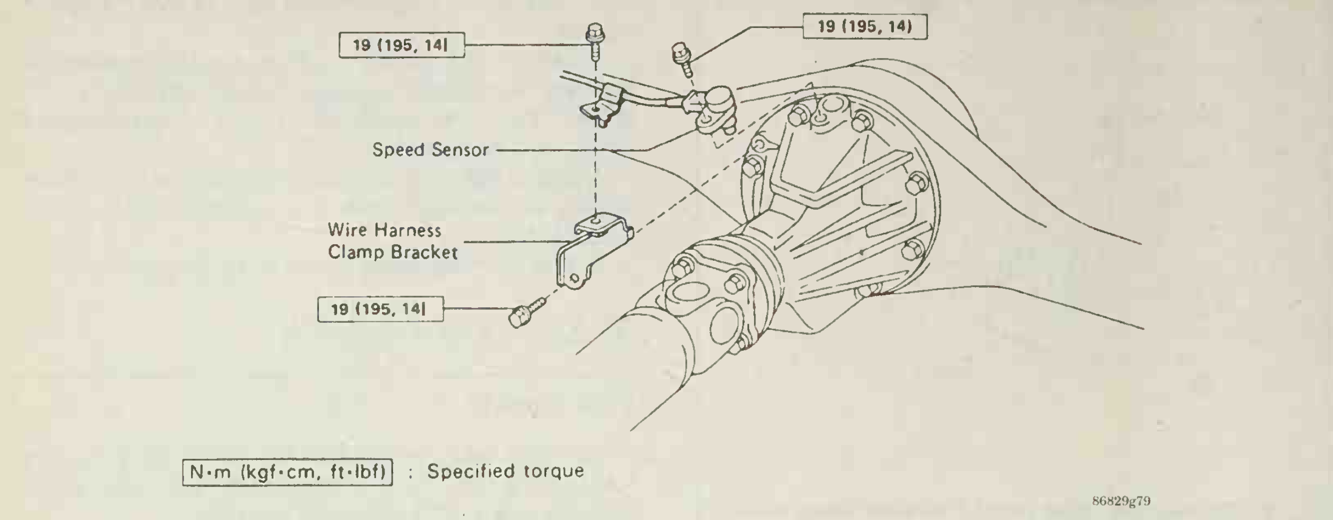


Fig. 86 Exploded view of the speed sensor mounting

2. Remove the retaining bolt holding the sensor to the differential.
3. Remove the sensor straight out of its mount. Protect the tip from impact or abrasion.

To install:

4. Install the sensor, making certain it is firmly seated and not crooked in its mount.
5. Tighten the retaining bolt to 14 ft. lbs. (19 Nm).
6. Reinstall any mounting clips or brackets for the sensor cable, then attach the cable to the ABS harness.
7. Double check the cable routing; it must be completely clear of any moving components.

Deceleration Sensor

SYSTEM TEST

Refer to the speed sensor system test.

COMPONENT TESTING

The deceleration sensor is located in the center of the vehicle behind the lower dash cover. It transmits signals to the ECU regarding deceleration rate.

➡The following procedures require driving the vehicle while it is in the diagnostic mode. The anti-lock system will be disabled; only normal braking function will be available.

1. Check the battery voltage with the engine off; voltage should be approximately 12 volts.
2. With the ignition switch **ON**, make certain the REAR ANTI-LOCK warning lamp comes on for about 2 seconds and then goes out. Turn the ignition switch **OFF**.
3. Use a jumper wire to attach terminals Tc, Ts and E1 at the DLC1 connector.
4. Apply the parking brake fully, depress the brake pedal and start the engine.
5. After a short delay, the dashboard warning lamp should flash about once every second. This is slower than the usual system flashing when transmitting a code.
6. Release the parking brake and drive the vehicle straight ahead at 12.4 mph (20 km) or greater speed. Strongly depress the brake pedal; the warning lamp should begin flashing evenly and rapidly, about 8 times per second.
7. Stop the vehicle and turn the ignition switch **OFF**. Remove the jumper wire from the DLC1 connector.
8. If the warning lamp display does not meet specifications, check the installation of the deceleration sensor. It must be correctly and securely installed. If installation is OK, replace the sensor and retest the system.

REMOVAL & INSTALLATION

➧ See Figures 87, 88 and 89

1. Remove the lower center cover from the instrument panel.
2. Remove the 2 bolts holding the deceleration sensor bracket and lift the unit free.
3. With the ignition **OFF**, unplug the wiring connector at the sensor. Remove the sensor and bracket assembly.

To install:

4. Attach the wire harness connector to the sensor. Install the sensor and bracket; tighten the retaining bolts to 48 inch lbs. (5.4 Nm).

➡The sensor must be mounted approximately level in the vehicle. The mounting bolts must be equally snug to keep the unit from rocking or being on an angle.

5. Install the lower center cover on the instrument panel.

Solenoid Relay

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.

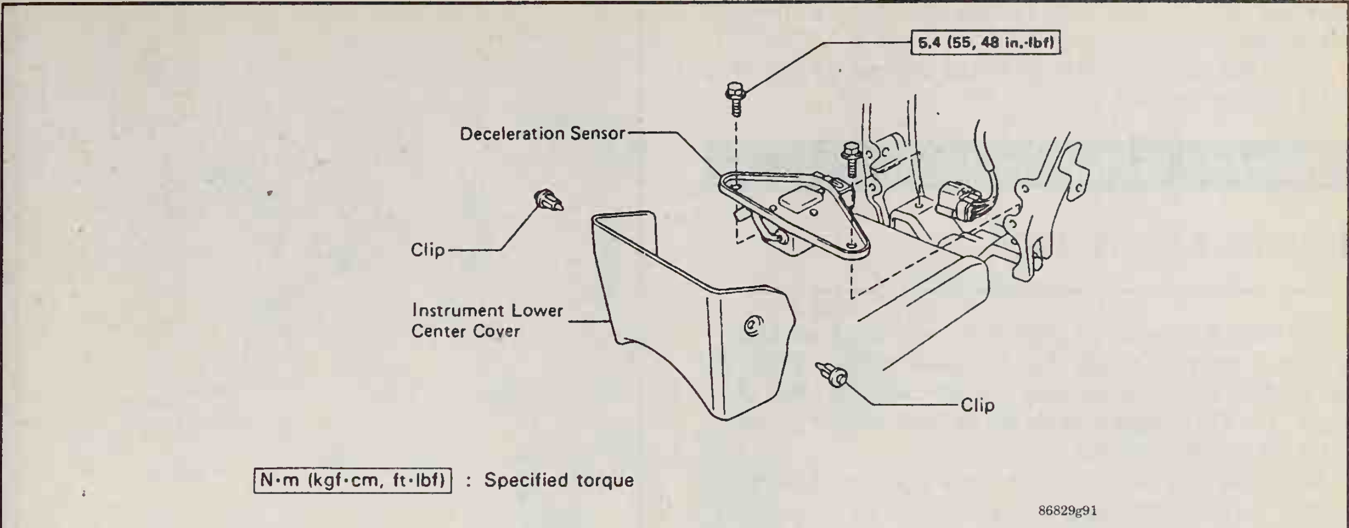

5.4 (55, 48 in.·lbf)
Deceleration Sensor
Clip
Instrument Lower
Center Cover
Clip
N·m (kgf·cm, ft·lbf) : Specified torque
86829g91

Fig. 87 Exploded view of the deceleration sensor mounting — Pick-Up shown

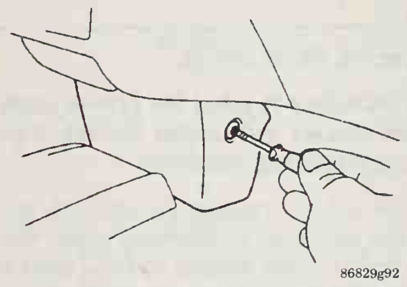


Fig. 88 Remove the lower instrument panel cover

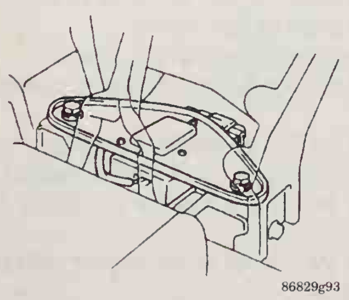


Fig. 89 Remove the 2 bolts that secure the bracket to the unit

2. Unbolt the solenoid from the inside of the right fender.

To install:

3. Mount and secure the sensor.
4. Connect the negative battery cable.

TESTING

➧ See Figure 90

This relay, mounted on the inside of the right fender under the hood, controls the flow of electricity to the solenoid valve of the actuator.

1. With the ignition switch **OFF**, remove the control relay from its bracket. The relay has 6 terminals.
2. Use an ohmmeter to test continuity. There should be continuity between terminals 1 and 6.
3. Place the lead of the ohmmeter on terminal 3; check for continuity at terminal 5. Place the lead on terminal 4; continuity should only be found between terminals 3 and 5.
4. Apply battery voltage to terminal 1 and ground terminal 6. Place the lead of the ohmmeter on terminal 2; check for

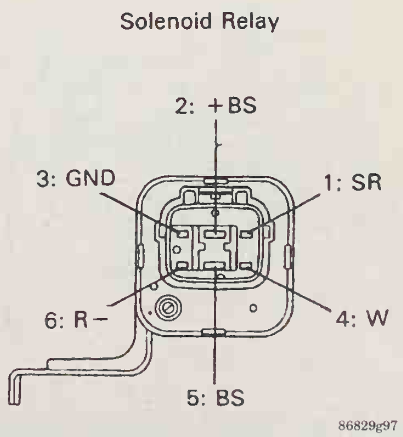

Solenoid Relay
2: +BS
3: GND
1: SR
6: R−
4: W
5: BS
86829g97

Fig. 90 The solenoid relay terminal locations

continuity at terminal 5. Place the lead on terminal 4; continuity should only be found between terminals 2 and 5.

5. All test conditions must be met. If any test is failed, the relay must be replaced.

Electronic Control Unit (ECU)

REMOVAL & INSTALLATION

The ECU is the electrical brain of the rear wheel anti-lock system. It interprets signals from the speed sensor and the deceleration sensor, determining if wheel lock-up is about to occur. The ECU output controls the solenoid relay which energizes the actuator solenoid.

Additionally, the ECU uses other input signals to determine system readiness and integrity. Should a fault be found, a fault code is assigned and stored in memory. The ECU will illuminate the REAR ANTI-LOCK warning lamp on the dashboard when a fault is noted. The ECU is located behind the glove box on the upper underside of the dash.

1. Remove the 4 screws and 1 bolt holding the glove box in place and remove the glove box assembly.
2. Remove the 2 screws and 1 nut holding the ECU in place. Gently pull the ECU down for access.
3. Make certain the ignition switch is **OFF**. Unplug the wiring connector from the ECU and remove the unit.

To install:

4. With the ignition **OFF**, attach the ECU to the wire harness.
5. Install the unit, tightening the nuts and bolts snugly.
6. Reinstall the glove box.

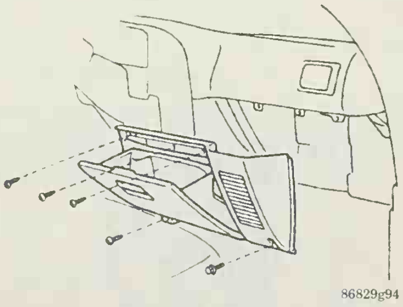


Fig. 91 Remove the glove box assembly form the vehicle

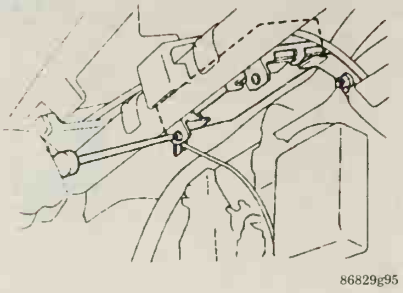


Fig. 92 Remove the retainers securing the ECU

Actuator

REMOVAL & INSTALLATION

See Figures 93, 94, 95 and 96

➡It will be necessary to bleed the system using Toyotas ABS actuator checker and adapter harness. Refer to the actuator system bleeding procedure.

The hydraulic actuator contains the solenoid valve as well as the bypass and cut valves for the brake circuit. The solenoid controls the flow of power steering fluid into control circuits. The power steering fluid within these circuits act on pistons which move the bypass and cut valves, controlling the flow of brake fluid. The actuator is located at the lower right front of the engine compartment.

1. Disconnect both battery cables, negative cable first. Remove the battery and tray.
2. Disconnect the electrical harness at the actuator.
3. Disconnect the two brake lines from the actuator. Plug the lines to prevent fluid loss and the entry of dirt.
4. Turn the steering wheel clockwise until it locks. Remove the union (banjo) bolts holding the power steering pressure hoses to the actuator. It may be easier to work through the wheel house instead of from the top.
5. Disconnect the power steering hose(s).
6. Remove the bolt holding the power steering hose clamp or retainer.
7. Remove the 3 bolts holding the actuator bracket to the body. Remove the actuator and bracket together.
8. Remove the bracket from the actuator on the workbench.

To install:

9. Reinstall the bracket to the actuator; tighten the 3 bolts to 9 ft. lbs. (13 Nm).
10. Install the actuator to the vehicle; install the front retaining bolt first, then the middle one and then the rear most one. Tighten each to 21 ft. lbs. (28 Nm) when it is installed.
11. Using new gaskets, connect the pressure unions. Tighten each bolt to 34 ft. lbs. (47 Nm).

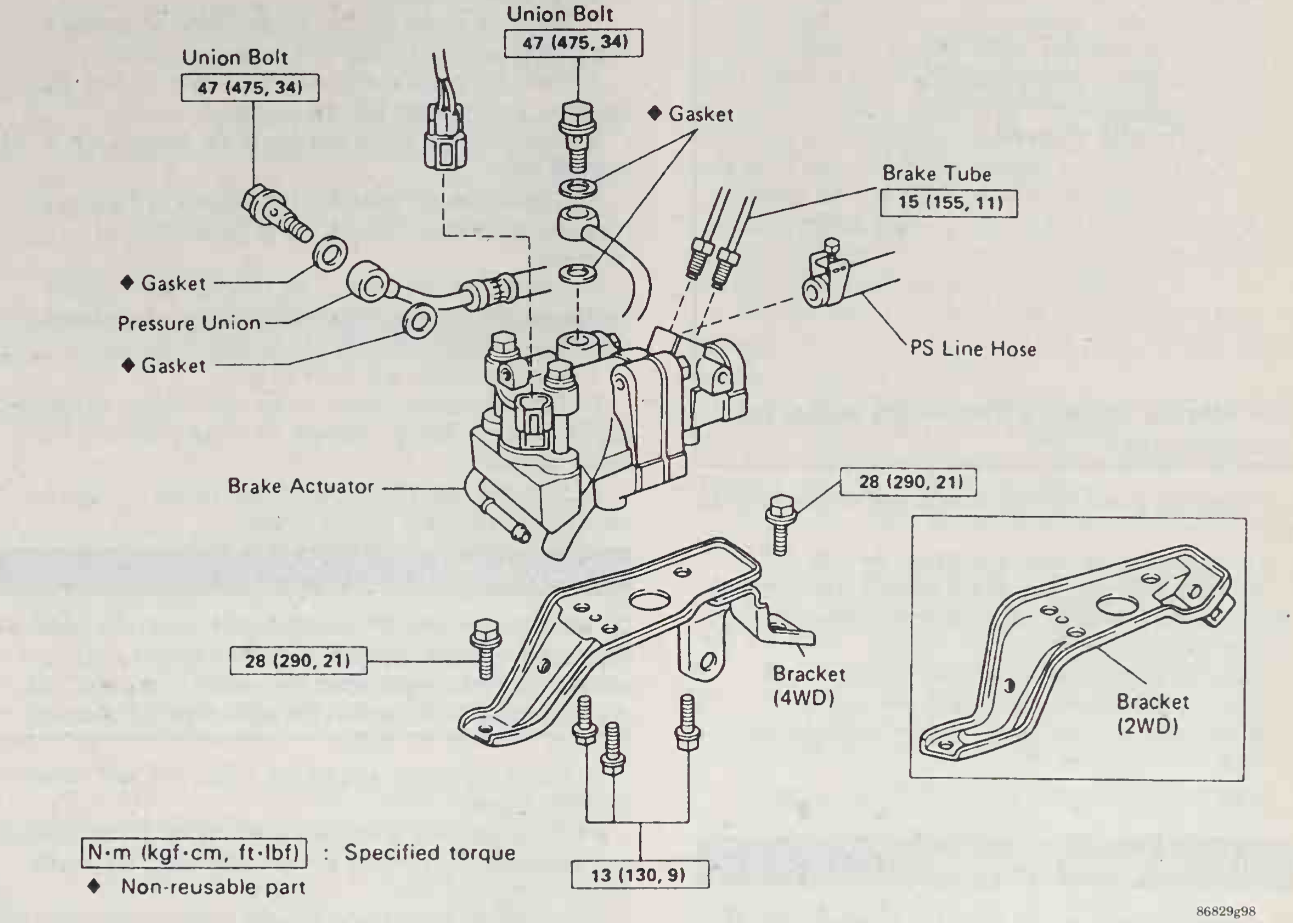

Union Bolt
47 (475, 34)
Union Bolt
47 (475, 34)
◆ Gasket
Brake Tube
15 (155, 11)
◆ Gasket
Pressure Union
◆ Gasket
PS Line Hose
Brake Actuator
28 (290, 21)
28 (290, 21)
Bracket (4WD)
Bracket (2WD)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
13 (130, 9)
86829g98

Fig. 93 Exploded view of the ABS actuator components

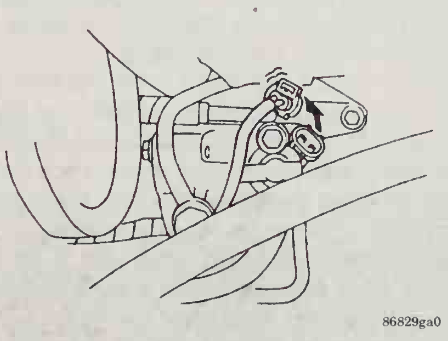


Fig. 94 Unplug the actuator harness

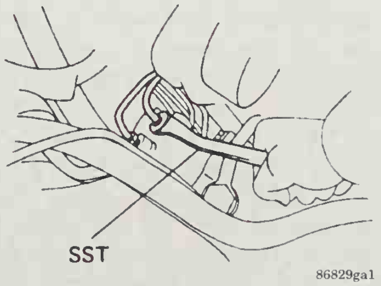

SST
86829ga1

Fig. 95 Using a line wrench, disconnect the brake lines leading to the actuator

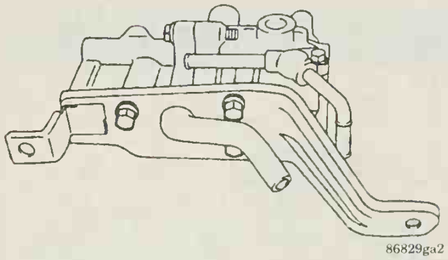


Fig. 96 After the actuator is removed, the bracket can be separated from it

12. Connect the power steering hose(s) and secure the hose clamp(s).
13. Install the retaining clamp and tighten the bolt.
14. Connect the 2 brake lines to the actuator. Connect the painted line to the painted actuator port first. Tighten the lines to 11 ft. lbs. (15 Nm).
15. Attach the electrical harness to the actuator.
16. Install the battery and tray; connect the cables.
17. Fill the brake fluid and power steering reservoirs with the correct fluid.
18. Bleed the brake system and power steering system.

Actuator System Bleeding

➡This procedure requires the use of the Toyota ABS Actuator Checker and adapter harness (Tools 09990-00150 and 09990-00205) or their equivalent.

Whenever the actuator or any power steering hoses are disconnected, the actuator should be bled using the following procedure. Normal bleeding of each system may not remove all the air from the actuator.

1. Bleed the power steering system. Refer to Section 8. The bleeder valve is located on the steering gearbox.
2. Bleed the brake system with the engine running. Bleed the brake system again with the engine off.
3. Disconnect the wiring harness at the actuator and at the solenoid relay.
4. Connect the ABS checker and harness to the actuator, relay and body wiring harness, using the adapters as necessary.
5. Connect the red cable of the checker to the positive battery terminal and the black cable to the negative battery terminal.
6. Start the engine and run it at idle.
7. Turn the selector switch on the ABS checker to the AIR BLEED position. Strongly depress the brake pedal and hold it in that position.
8. Push the ON/OFF switch (on the checker) for about 3 seconds and release it; do this 5 times.

✳✳WARNING

Do not push the ON/OFF switch before the brake pedal is depressed — master cylinder damage may occur. Do not release the brake pedal while the switch is engaged. Do not hold the ON/OFF switch ON more than 5-7 seconds.

9. After 5 repetitions, release the switch and then release the brake pedal.
10. Check the level of the power steering and brake fluids in their reservoirs; top off each as necessary using the correct fluid.
11. Disconnect and remove the ABS checker. Reconnect the system harness.

4-WHEEL ANTI-LOCK BRAKE SYSTEM

General Information

Anti-lock Brake Systems (ABS) are designed to prevent locked-wheel skidding during hard braking or during braking on slippery surfaces. The front wheels of a vehicle cannot apply steering force if they are locked and sliding; the vehicle will continue in the previous direction of travel. The 4-wheel ABS system used on Toyota trucks holds the wheels just below the point of locking, thereby allowing some steering response and preventing the rear of the vehicle from sliding sideways.

There are conditions for which the ABS system provides no benefit. Hydroplaning is possible when the tires ride on a film of water, losing contact with the paved surface. This renders the vehicle totally uncontrollable until road contact is regained. Extreme steering maneuvers at high speed or cornering beyond the limits of tire adhesion can result in skidding which is independent of vehicle braking. For this reason, the system is named anti-lock rather than anti-skid. Wheel spin during acceleration on slippery surfaces may also fool the system into detecting a system failure and entering the fail-safe mode.

Under normal conditions, the ABS system functions in the same manner as a standard brake system and is transparent to the operator. The system is a combination of electrical and hydraulic components, working together to control the flow of brake fluid to the wheels when necessary.

The Electronic Control Unit (ECU) is the electronic brain of the system, receiving and interpreting signals from the wheel speed sensors. The unit will enter anti-lock mode when it senses impending wheel lock at any wheel, and will immediately control the brake line pressures to the affected wheel(s) by issuing output signals to the actuator assembly.

The actuator contains solenoids which react to the signals from the ECU. Each solenoid controls brake fluid pressure to one wheel. The solenoids allow brake line pressure to build according to brake pedal pressure, hold (by isolating the system from the pedal and maintaining current pressure) or decrease (by isolating the pedal circuit and bleeding some fluid from the line).

The decisions regarding these functions are made very rapidly, as each solenoid can be cycled up to 10 times per second.

The operator may feel a pulsing in the brake pedal and/or hear popping or clicking noises when the system engages. These sensations are due to the valves cycling and the pressures being changed rapidly within the brake system. While completely normal and not a sign of system failure, these sensations can be disconcerting to an operator unfamiliar with the system.

Although the ABS system prevents wheel lock-up under hard braking, as brake pressure increases, wheel slip is allowed to increase as well. This slip will result in some tire chirp during ABS operation. The sound should not be interpreted as lock-up but rather as an indication of the system holding the wheel(s) just outside the locking point.

Diagnosis and Testing

PRECAUTIONS

- Certain components within the system are not intended to be serviced or repaired individually. Only those components with removal and installation procedures should be serviced.
- Do not use rubber hoses or other parts not specifically specified for the anti-lock system. When using repair kits, replace all parts included in the kit.
- Use only DOT 3 brake fluid from an unopened container.
- If any hydraulic component (either power steering or brake) is removed or replaced, it may be necessary to bleed the entire system.
- A clean repair area is essential. Always clean the reservoir and cap thoroughly before removing the cap. The slightest amount of dirt in the fluid may plug an orifice and impair the system function. Perform repairs after components have been thoroughly cleaned; use only denatured alcohol to clean components. Do not allow components to come into contact with any substance containing mineral oil; this includes used shop rags.
- The ECU is a microprocessor similar to other computer units in the vehicle. Insure that the ignition switch is **OFF** before removing or installing controller harnesses. Avoid static electricity discharge at or near the controller.
- If any arc welding is to be done on the vehicle, the ECU should be disconnected before welding operations begin.
- If the vehicle is to be baked after paint repairs, remove the ECU from the vehicle.

INSPECTION

If a malfunction occurs, the system will identify the problem and the computer will assign and store a fault code for the fault(s). The dashboard warning lamp will be illuminated to inform the driver that a fault has been found.

During diagnostics, the system will transmit the stored code(s) by flashing the dashboard warning lamp. If two or more codes are stored, they will be displayed from lowest number to highest, regardless of the order of occurrence. The system does not display the diagnostic codes while the vehicle is running.

Visual Inspection

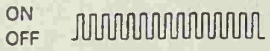
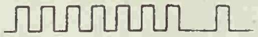
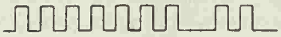
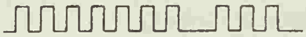
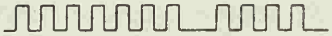
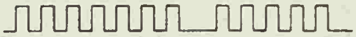
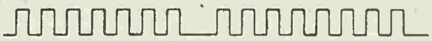
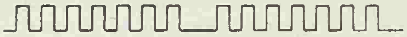
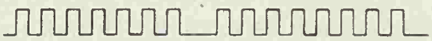
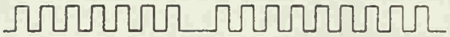
Before diagnosing an apparent rear anti-lock problem, make absolutely certain that the normal braking system and power steering systems are in correct working order. Many common problems (dragging parking brake, seepage, etc.) will affect the ABS system. A visual check of specific system components may reveal problems creating an apparent ABS malfunction. Performing this inspection may reveal a simple failure, thus eliminating extended diagnostic time.

- Inspect the brake fluid level in the reservoir.
- Inspect lines, hoses, master cylinder assembly, brake calipers and cylinders for leakage. Inspect the power steering system and components for the same conditions.
- Visually check lines and hoses for excessive wear, heat damage, punctures, contact with other parts, missing clips or holders, blockage or crimping.
- Check the calipers or wheel cylinders for rust or corrosion. Check for proper sliding action if applicable.
- Check the caliper and wheel cylinder pistons for freedom of motion during application and release.
- Inspect the speed sensor for proper mounting and correct connection.
- Confirm the fault occurrence. Certain driver induced faults, such as not releasing the parking brake fully, will set a fault code and trigger the dash warning light. Excessive wheel spin on low-traction surfaces, high speed acceleration or riding the brake pedal may also set fault codes and trigger a warning lamp. These induced faults are not system failures but examples of vehicle performance outside the parameters of the control unit.
- Many system shut-downs are due to loss of sensor signals to or from the controller. The most common cause is not a failed sensor but a loose, corroded or dirty connector. Check harness and component connectors carefully.

Reading Codes

➧ See Figure 97

1. Turn the ignition switch **OFF**. Check battery condition; approximately 12 volts is required to operate the system.
2. Turn the ignition switch **ON** and check that the ABS dashboard warning lamp comes on for 3 seconds. If the lamp does not come on, repair the fuse, bulb or wiring.
3. Use a jumper wire to attach terminals Tc and E1 of the Data Link Connector (DLC1). This is not the service connector. Turn the ignition **ON**.
4. If a fault code has been set, the dashboard warning lamp will begin to blink 4 seconds later. The number of flashes corresponds to the first digit of a 2-digit code; after a 1.5 second pause, the second digit is transmitted. If a second code is stored, it will be displayed after a 2.5 second pause. Once all codes have been displayed, the entire series will repeat after a 4 second pause. If no codes have been stored, the warning lamp will flash continuously every ½ second with no variation.
5. Turn the ignition switch **OFF**.
6. Check or repair the system as indicated by the fault code.
7. After repairs are completed, clear the codes from the memory. If the battery is disconnected during repairs, the controller memory will be erased of all stored codes.

Code No.	Light Pattern	Diagnosis	Malfunctioning Part
		All speed sensors and sensor rotors are normal	
71		Low voltage of right front speed sensor signal	• Right front speed sensor • Sensor installation
72		Low voltage of left front speed sensor signal	• Left front speed sensor • Sensor installation
73		Low voltage of right rear speed sensor signal	• Right rear speed sensor • Sensor installation
74		Low voltage of left rear speed sensor signal	• Left rear speed sensor • Sensor installation
75		Abnormal change of right front speed sensor signal	• Right front sensor rotor
78		Abnormal change of left front speed sensor signal	• Left front sensor rotor
72		Abnormal change of right rear speed sensor signal	• Right rear sensor rotor
78		Abnormal change of left rear speed sensor signal	• Left rear sensor rotor
79		Deceleration sensor is faulty	• Deceleration sensor • Sensor installation

86829gll

Fig. 97 Diagnostic trouble codes for 4-wheel ABS

8. Remove the jumper wire if one was used and reattach the service connector at the actuator.

Clearing Codes

1. Detach the service connector at the actuator.
2. Use the jumper wire to connect terminals Tc and E1 of the Data Link Connector (DLC1). Turn the ignition **ON**.
3. Clear the diagnostic trouble codes stored in the ECU by depressing the brake pedal 8 or more times within 3 seconds.
4. After the rapid pedal application, the dash warning lamp should display constant flashing, indicating a normal system. If codes are still displayed, make certain the repairs made to the system are correct. Also inspect the brake light switch at the brake pedal for any binding or sticking.
5. Once the codes are cleared, disconnect the jumper wire. The dash warning lamp should go out.

Speed Sensor

SYSTEM TEST

➡The following procedures require driving the vehicle while it is in the diagnostic mode. The anti-lock system will be disabled; only normal braking function will be available.

1. If working on a 4WD vehicle, make certain it is only in 2WD. Check the battery voltage with the engine **OFF**; voltage should be approximately 12 volts.
2. With the ignition switch **ON**, make certain the ABS warning lamp comes on for about 3 seconds and then goes out. Turn the ignition switch **OFF**.
3. Using a 3-way jumper, connect terminals Tc, Ts and E1 at the Data Link Connector (DLC1).
4. Pull the parking brake on securely and start the motor without stepping on the brake pedal. Depressing the brake

pedal will either void the test or cause the system to enter a different diagnostic mode.

5. The dashboard warning lamp should flash evenly about 4 times per second. If, instead, a code is flashed, repairs must be made and the code(s) cleared before continuing. If the light does not flash, check the parking brake switch, the DLC1 connector and the wiring to the ABS controller.

6. To check the sensor signal level, release the parking brake and drive the vehicle straight ahead at low speed. Once a speed of 2-5 mph (3-8 km) is reached, the warning lamp should turn off. Once the light has gone off, it should begin to blink as the vehicle leaves the speed range. This blinking is normal and indicates the speed sensor is operating correctly. If no blinking occurs, the system is defective.

7. Check the sensor signal change by driving the vehicle on the road. Once a speed of 25-31 mph (40-50 km) is achieved, the warning lamp should come on after a one second pause. As before, the lamp should blink evenly as the vehicle leaves the speed range; failure to blink indicates a system fault.

➡While the warning lamp is off, do not subject the vehicle to any shocks or impact such as shifting, acceleration, deceleration or road impact.

8. Stop the vehicle in a safe location and apply the parking brake fully. Read and record any stored codes which are displayed.

9. Turn the ignition switch **OFF**; remove the jumper wire from the DLC1 connector.

COMPONENT TEST

Front Sensor

➧ See Figures 98, 99, 100, 101 and 102

1. Unplug the speed sensor connector.

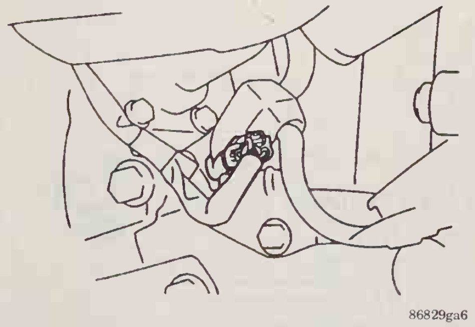


Fig. 98 Unplug the speed sensor connection

2. Measure the resistance between terminals 1 (FL-) and 2 (FL+). The resistance should be as follows:

- 4Runner — 1.4-1.8k ohms
- T100 — 0.6-1.8k ohms
- Land Cruiser — 0.97-1.77k ohms

3. If the resistance is not as specified, replace the sensor.

4. Check that there is no continuity between each terminal and the sensor body. If there is continuity, replace the sensor.

5. Attach the speed sensor harness.

6. Check the installation of the sensor. If the mounting bolt is loose, tighten it to 69 inch lbs. (8 Nm).

7. Remove the axle hub with the rotor. Inspect the sensor rotor serrations for scratches, cracks, warping or missing teeth. Replace if necessary.

➡To prevent from damaging the serrations, do not strike the axle hub with the rotor.

8. Reconnect the speed sensor to the harness.

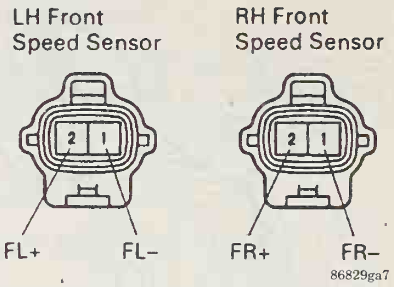


Fig. 99 Sensor terminal locations

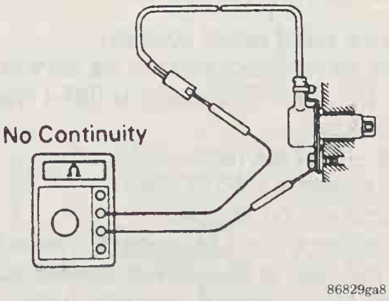


Fig. 100 Using an ohmmeter, check for continuity between the sensor and the terminals

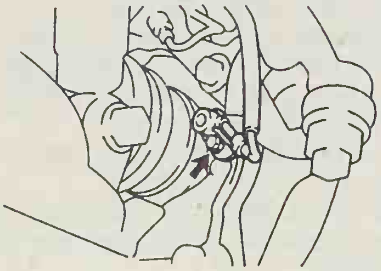


Fig. 101 The sensor is secured by a single bolt

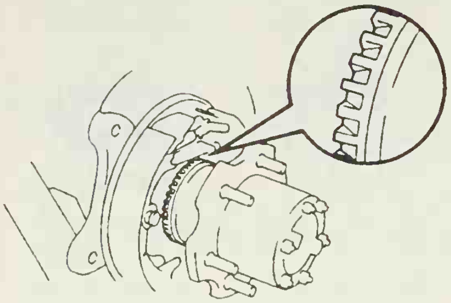


Fig. 102 Check the sensor rotor for any damage. Replace if necessary

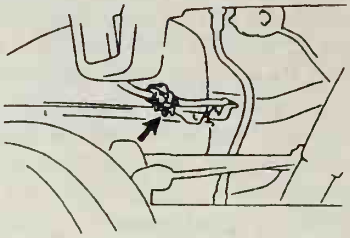


Fig. 103 Unplug the harness leading to the rear sensor

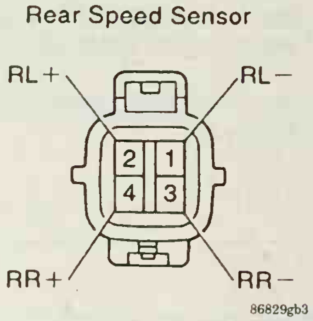


Fig. 104 The rear sensor terminal pins

Rear Sensor

➧ See Figures 103, 104, 105 and 106

1. Unplug the speed sensor connector.
2. Measure the resistance between the terminal 1 (RL-) and 2 (RL+). The is 1 is (RR-) and 2 is (RR+) resistance should be as follows:
   - T100 — 0.6-2.05k ohms
   - Land Cruiser — 0.5-1.6k ohms
   - 4Runner — 1.0-1.4k ohms
3. If the resistance is not as specified, replace the sensor.
4. Check that there is no continuity between each terminal and the sensor body. If there is continuity, replace the sensor.
5. Attach the speed sensor harness.
6. Check the installation of the sensor. If the mounting bolt is loose, tighten it to 69 inch lbs. (8 Nm).
7. Remove the axle hub with the rotor. Inspect the sensor rotor serrations for scratches, cracks, warping or missing teeth.

➡To prevent from damaging the serrations, do not strike the axle hub with the rotor.

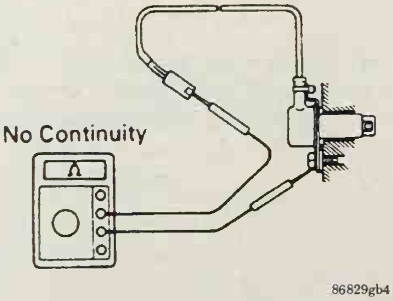


Fig. 105 Using an ohmmeter, check for continuity on the sensor

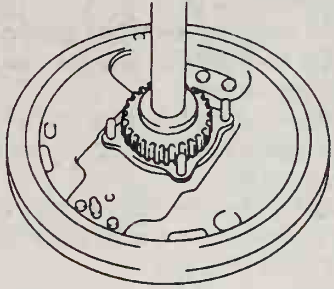


Fig. 106 Check the sensor rotor for any damage. Replace if necessary

REMOVAL & INSTALLATION

Front

➧ See Figures 107 and 108

1. Unplug the speed sensor harness to the unit.
2. On 4WD vehicles, remove the clamp bolts and clips holding the sensor harness from the frame, upper arm and steering knuckle.
3. On 2WD vehicles, remove the clamp bolts and clips holding the sensor harness to the frame and upper arm.

➡**Discard the old clips.**

4. Remove the sensor from the knuckle.

To install:

5. Attach the sensor to the steering knuckle, tighten to 69-71 inch lbs. (7-8 Nm).
6. Attach the harness along the upper arm and frame with new clips. Tighten the mounting bolts to 48-71 inch lbs. (5-8 Nm).

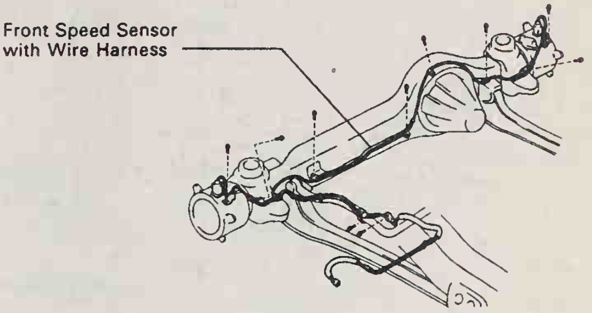


Fig. 108 Front speed sensor mounting harness routing — Land Cruiser shown

7. Engage the sensor harness to the unit.

Rear

➧ See Figures 109 and 110

1. Unplug the speed sensor harness to the unit.
2. Remove the clamp bolts and nuts holding the sensor harness from the frame, upper arm, axle housing and fuel tank (if attached).

➡**Discard the old clips.**

3. Remove the sensor from the axle.

To install:

4. Attach the sensor to the axle, tighten to 69-71 inch lbs. (7-8 Nm).
5. Attach the harness along the appropriate areas, then tighten the mounting bolts to 48-71 inch lbs. (5-8 Nm). Be sure to used all new clips, and install them in the same angle of the removed ones.
6. Engage the sensor harness to the unit.

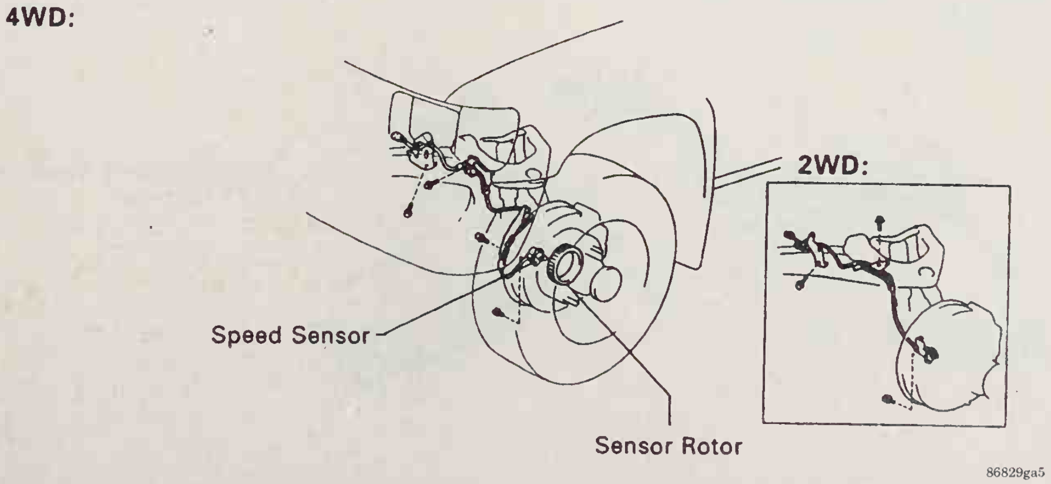


Fig. 107 Exploded view of the front speed sensor mounting and harness routing — T100 shown

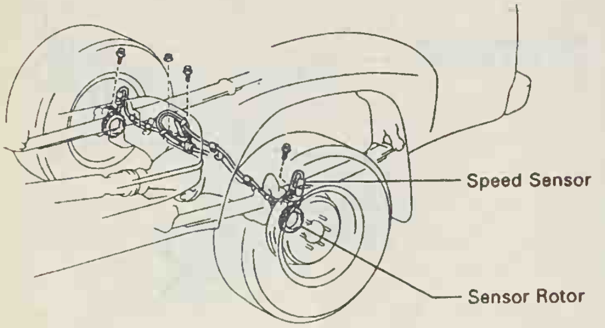


Fig. 109 The rear speed sensor is mounted along the rear axle — T100

Deceleration Sensor

SYSTEM TEST

Refer to the speed sensor system test.

COMPONENT TESTING

➡The following procedures require driving the vehicle while it is in the diagnostic mode. The anti-lock system will be disabled; only normal braking function will be available.

1. Check the battery voltage with the engine **OFF**; voltage should be approximately 12 volts.
2. With the ignition switch **ON**, make certain the ABS warning lamp comes on for about 2 seconds and then goes out. Turn the ignition switch **OFF**.
3. Use a jumper wire to attach terminals Ts and E1 at the Data Link Connector (DLC1).
4. Apply the parking brake fully, depress the brake pedal and start the engine.
5. After a short delay, the dashboard warning lamp should flash about 4 times every second. Stop the vehicle on a level surface for about one second.
6. Drive the vehicle straight ahead at 28 mph (45 kph) or greater speed for, several seconds. The warning light should be off when it works normally.
7. Stop the vehicle, then the light will begin to blink. Attach the jumper wire to terminals Tc and E1 of the DLC1. Read the number of blinks of the ABS light.
8. The light blinks about 2 times ever second. If 2 or more blinks are indicated at the same time, the smallest numbered code will be displayed first.
9. Repair any malfunctioning parts. Be sure the ignition switch is in the **OFF** position.
10. Remove the jumper wire from the Tc, Ts and E1 terminals of the DLC1.

Actuator

REMOVAL & INSTALLATION

➧ See Figures 111 and 112

1. Disconnect and plug the brake lines.
2. Unplug the ABS connectors from the actuator.
3. Remove the bolts and nuts to release the assembly from the vehicle.
4. Unbolt the unit from the bracket.

To install:

5. Attach the ABS actuator to the bracket, tighten the mounting nuts to 48 inch lbs. (5 Nm).
6. Install the actuator with bracket to the vehicle, tighten the mounting bolts to 14 ft. lbs. (19 Nm).
7. Attach the brake lines to the actuator, tighten them to 11 ft. lbs. (15 Nm).

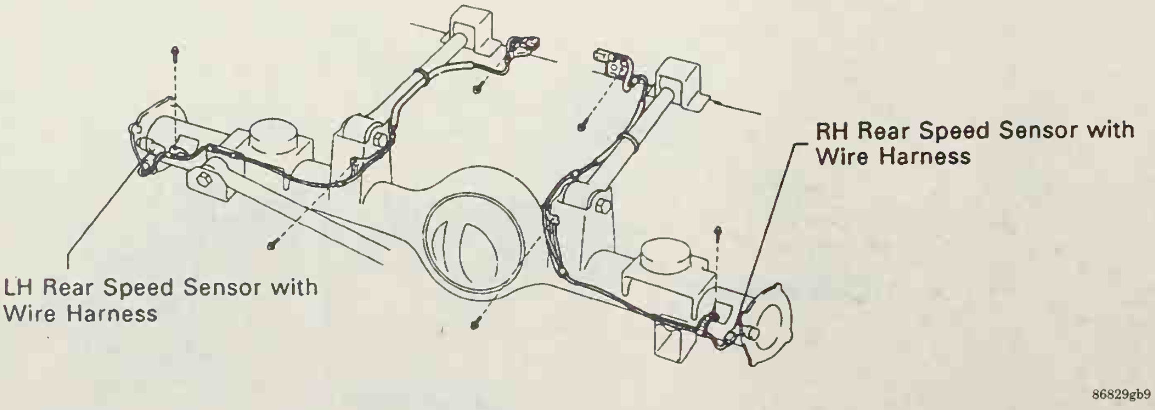

RH Rear Speed Sensor with Wire Harness
LH Rear Speed Sensor with Wire Harness
86829gb9

Fig. 110 The rear speed sensor is mounted along the rear axle — Land Cruiser

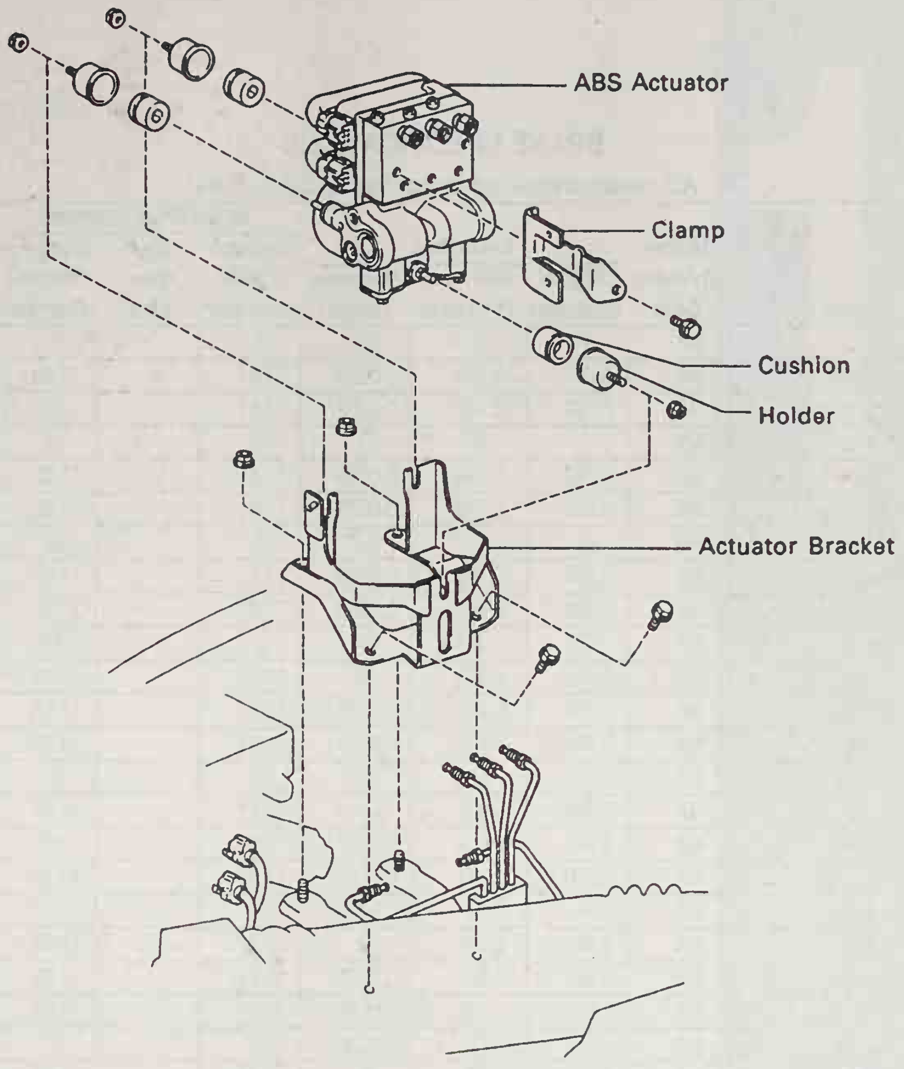

ABS Actuator
Clamp
Cushion
Holder
Actuator Bracket
86829gc0

Fig. 111 Exploded view of the ABS actuator — T100 shown

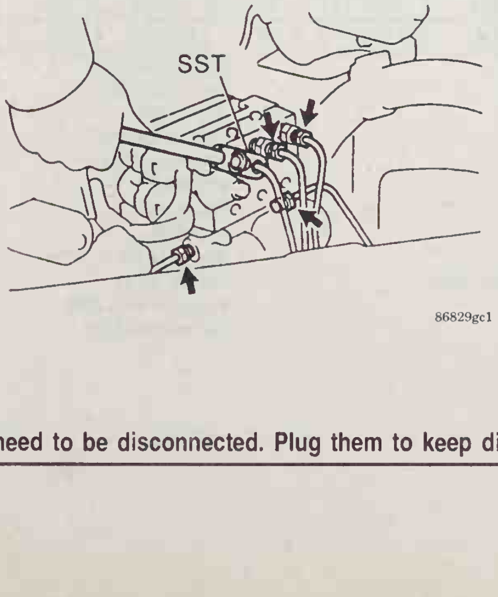

SST
86829gc1

Fig. 112 There are 5 brake lines that need to be disconnected. Plug them to keep dirt from entering

BRAKE SPECIFICATIONS

All measurements in inches unless noted

			Brake Disc			Brake Drum Diameter			Minimum Lining Thickness	
Year	Model	Master Cylinder Bore	Original Thickness	Minimum Thickness	Maximum Runout	Original Inside Diameter	Max. Wear Limit	Maximum Machine Diameter	Front	Rear
1989	Pick-up	NA	①	②	③	④	-	⑤	0.039	0.039
	4Runner	NA	0.787	0.709	0.0035	11.61	-	11.69	0.039	0.039
	Land Cruiser	NA	0.787	0.748	0.0059	11.61	-	11.69	0.157	0.059
1990	Pick-up	NA	①	②	③	④	-	⑤	0.039	0.039
	4Runner	NA	0.787	0.709	0.0035	11.61	-	11.69	0.039	0.039
	Land Cruiser	NA	0.787	0.748	0.0059	11.61	-	11.69	0.157	0.059
1991	Pick-up	NA	①	②	③	④	-	⑤	0.039	0.039
	4Runner	NA	0.787	0.709	0.0035	11.61	-	11.69	0.039	0.039
	Land Cruiser	NA	0.984	0.906	0.0059	11.61	-	11.69	0.059	0.059
1992	Pick-up	NA	①	②	③	④	-	⑤	0.039	0.039
	T100	NA	0.984	0.906	⑥	11.61	-	11.69	⑦	⑧
	4Runner	NA	0.984	0.906	0.0035	11.61	-	11.69	0.059	0.039
	Land Cruiser	NA	0.984	0.906	0.0059	11.61	-	11.69	0.059	0.059
1993	Pick-up	NA	①	②	③	④	-	⑤	0.039	0.039
	T100	NA	0.984	0.906	⑥	11.61	-	11.69	⑦	⑧
	4Runner	NA	0.984	0.906	0.0035	11.61	-	11.69	0.059	0.039
	Land Cruiser	NA	1.260 ⑨	1.181 ⑩	0.0059	11.61	-	11.69	0.059	⑪
1994	Pick-up	NA	⑫	⑬	0.0035	④	-	⑥	⑭	0.039
	T100	NA	0.984	0.906	⑫	11.61	-	11.69	⑦	⑧
	4Runner	NA	0.984	0.906	0.0035	11.61	-	11.69	0.059	0.039
	Land Cruiser	NA	1.260 ⑨	1.181 ⑩	0.0059	11.61	-	11.69	0.059	⑪
1995	Pick-up	NA	⑫	⑬	0.0035	④	-	⑤	⑭	0.039
	T100	NA	0.984	0.906	⑥	11.61	-	11.69	⑦	⑧
	4Runner	NA	0.984	0.906	0.0035	11.61	-	11.69	0.059	0.039
	Land Cruiser	NA	1.260 ⑨	1.181 ⑩	0.0059	11.61	-	11.69	0.059	⑪
	Tacoma	NA	0.866	0.787	0.0028	④	-	⑤	0.039	0.039
1996	T100	NA	0.984	0.906	⑥	11.61	-	11.69	⑦	⑧
	4Runner	NA	0.984	0.906	0.0035	11.61	-	11.69	0.059	0.039
	Land Cruiser	NA	1.260 ⑨	1.181 ⑩	0.0059	11.61	-	11.69	0.059	⑪
	Tacoma	NA	0.866	0.787	0.0028	④	-	⑤	0.039	0.039

NA - Not Available

1 2WD (PD60 type disc): 0.984
2WD (PD66 type disc): 1.181
2WD (FS17, 18 type disc): 0.866
4WD (S12+12 type disc): 0.787

2 2WD (PD60 type disc): 0.906
2WD (PD66 type disc): 1.102
2WD (FS17, 18 type disc): 0.787
4WD (S12+12 type disc): 0.709

3 PD60, FS17, FS18, S12+12 type disc: 0.0035

4 2WD: 10.00, 4WD: 11.61

5 2WD: 10.08; 4WD: 11.69

6 2WD:1/2 Ton 0.0028
2WD:1 Ton 0.0035
4WD: 0.0028

7 2WD: 1/2 Ton 0.433
2WD: 1 Ton 0.374
4WD: 0.374

8 2WD: 0.276
4WD: 0.236

9 Rear disc: 0.630

10 Rear disc: 0.709

11 Brake shoe lining: 0.059
Disc pad lining: 0.039

12 2WD: 0.866; 4WD: 0.787

13 2WD: 0.787; 4WD: 0.709

14 2WD: 0.059; 4WD: 0.039

86829c50

10

BODY AND TRIM

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INTERIOR 10-23

EXTERIOR

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HOOD 10-2
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REMOVABLE TOP 10-17
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EXTERIOR

Doors

REMOVAL & INSTALLATION

➧ See Figure 1

1. Matchmark the hinge-to-body and hinge-to-door locations. Either support the door on jackstands or have somebody hold it for you.
2. On models with a center door check, push in on the claw and pull out the stopper pin. Alternatively, unbolt the door check from the door.

➡Depending on equipment, it may be necessary to disconnect various wires running into the door.

3. Remove the lower hinge-to-door bolts.
4. Remove the upper hinge-to-door bolts and lift the door off the hinges.
5. If the hinges are being replaced, remove them from the door pillar.

To install:

6. Install the door and hinges with the bolts finger-tight.
7. Adjust the door and tighten the hinge bolts to 15-22 ft. lbs. (20-30 Nm).
8. Install the door check.

ADJUSTMENT

➧ See Figures 2, 3 and 4

When checking door alignment, look carefully at each seam between the door and body. The gap should be constant and even all the way around the door. Pay particular attention to the door seams at the corners farthest from the hinges; this is the area where errors will be most evident. Additionally, the door should pull against the weatherstrip when latched to seal out wind and water. The contact should be even all the way around and the stripping should be about half compressed.

The position of the door can be adjusted in three dimensions: fore and aft, up and down, in and out. The primary adjusting points are the hinge-to-body bolts. Apply tape to the fender and door edges to protect the paint. Two layers of common masking tape works well. Loosen the bolts (using SST 09812-00010 if necessary) just enough to allow the hinge to move. With the help of an assistant, position the door and retighten the bolts. Inspect the door seams carefully and repeat the adjustment until correctly aligned.

The in-out adjustment (how far the door "sticks out" from the body) is adjusted by loosening the hinge-to-door bolts. Again, move the door into place, then retighten the bolts. This dimension affects both the amount of crush on the weatherstrips and the amount of "bite" on the striker.

Further adjustment for closed position and smoothness of latching is made at the latch plate or striker. This piece is located at the rear edge of the door and is attached to the bodywork; it is the piece the latch engages when the door is closed.

Although the striker size and style may vary between models or from front to rear, the method of adjusting it is the same:

1. Loosen the large cross-point screw(s) holding the striker. Know in advance that these bolts will be very tight; an impact screwdriver is a handy tool to have for this job. Make sure you are using the proper size bit.
2. With the bolts just loose enough to allow the striker to move if necessary, hold the outer door handle in the released position and close the door. The striker will move into the correct location to match the door latch. Open the door and tighten the mounting bolts. The striker may be adjusted towards or away from the center of the car, thereby tightening or loosening the door fit. The striker can be moved up and down to compensate for door position, but if the door is correctly mounted at the hinges this should not be necessary.

➡Do not attempt to correct height variations (sag) by adjusting the striker.

3. Additionally, some models may use one or more spacers or shims behind the striker. These shims may be removed or added in combination to adjust the reach of the striker.
4. After the striker bolts have been tightened, open and close the door several times. Observe the motion of the door as it engages the striker; it should continue its straight-in motion and not deflect up or down as it hits the striker.
5. Check the feel of the latch during opening and closing. It must be smooth and linear, without any trace of grinding or binding during engagement and release.

It may be necessary to repeat the striker adjustment several times (and possibly re-adjust the hinges) before the correct door to body match is produced.

Hood

REMOVAL & INSTALLATION

➧ See Figures 5, 6 and 7

➡You'll need an assistant for this job.

1. Open the hood.
2. Matchmark the hood-to-hinge position.
3. Disconnect the washer hoses.
4. Remove the hood-to-hinge bolts and lift off the hood.

To install:

5. With a helper, place the hood into position aligning the matchmarks.
6. Tighten the hinge bolts to the body of the vehicle.
7. Adjust if necessary.

ADJUSTMENT

➧ See Figures 8, 9, 10, 11 and 12

➡A tapered, self-centering bolt is used as the hood hinge set bolt. The hood cannot be adjusted with this bolt in place. Remove it and substitute a bolt and washer which will allow adjustment.

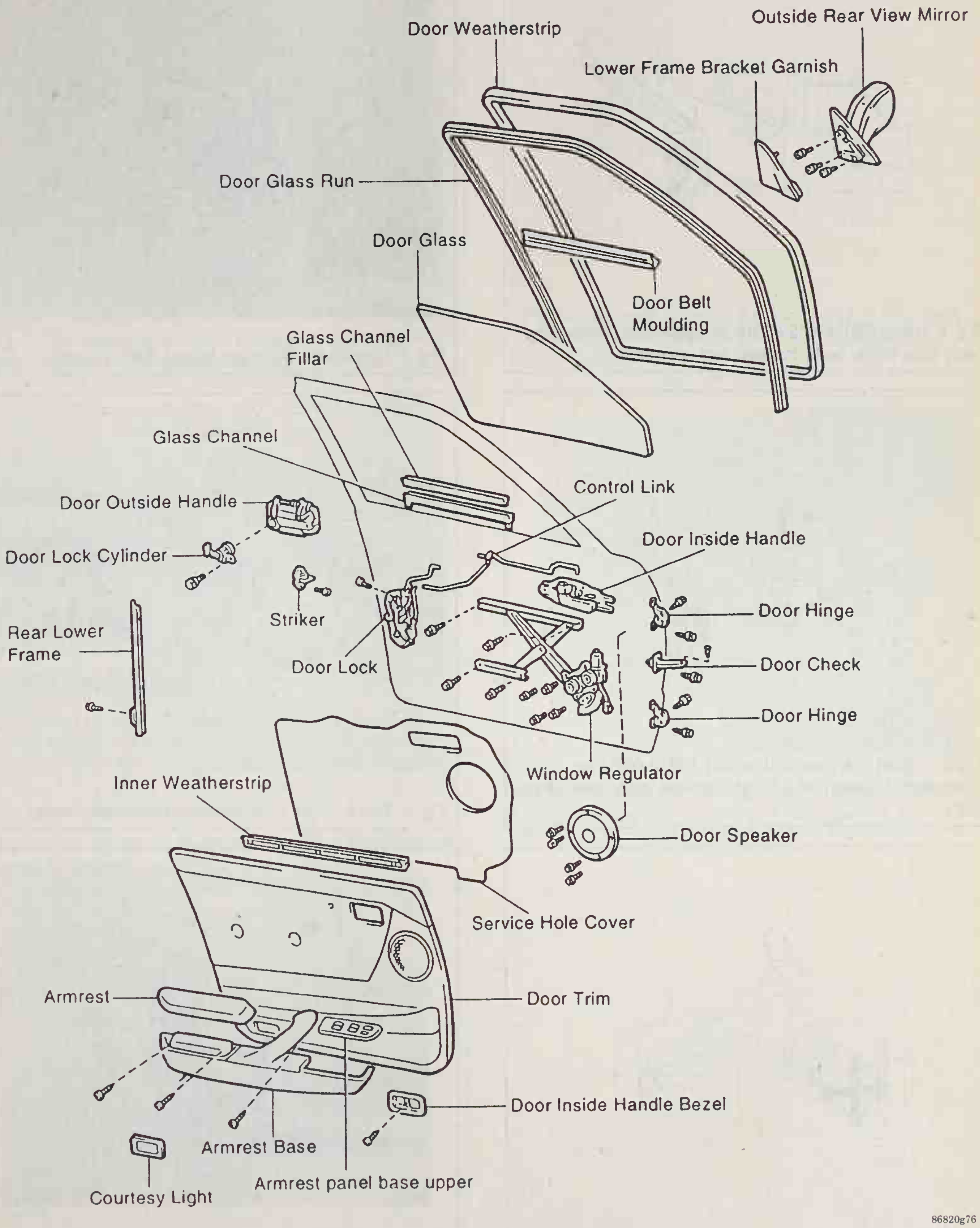

Door Weatherstrip
Outside Rear View Mirror
Lower Frame Bracket Garnish
Door Glass Run
Door Glass
Door Belt
Moulding
Glass Channel
Fillar
Glass Channel
Control Link
Door Outside Handle
Door Inside Handle
Door Lock Cylinder
Door Hinge
Striker
Rear Lower
Frame
Door Check
Door Lock
Door Hinge
Window Regulator
Inner Weatherstrip
Door Speaker
Service Hole Cover
Armrest
Door Trim
Door Inside Handle Bezel
Armrest Base
Courtesy Light
Armrest panel base upper
86820g76

Fig. 1 Exploded view of a typical front door — 1995-96 Land Cruiser shown

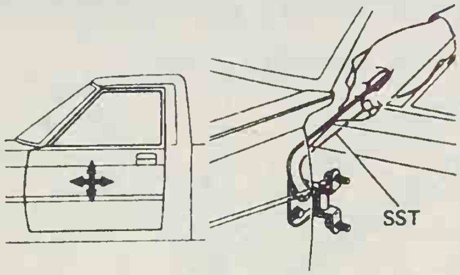

SST
86820g30

Fig. 2 Using SST 09812-00010 or equivalent, loosen the body side hinge bolts forward and rearward

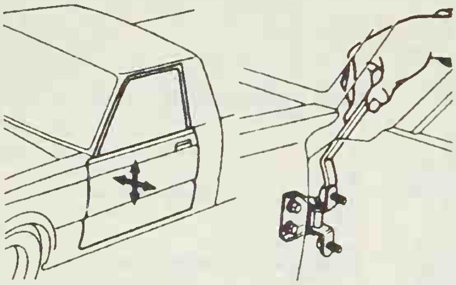


Fig. 3 Adjust the door with a SST 09812-00010 or equivalent. Loosen the left/right vertical body side hinge bolts

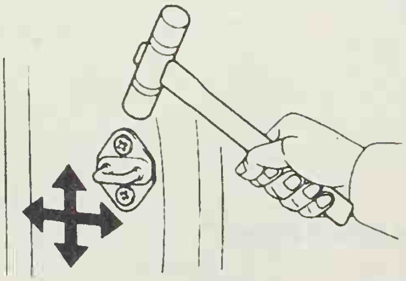


Fig. 4 A plastic hammer can be used to tap the striker for adjustment

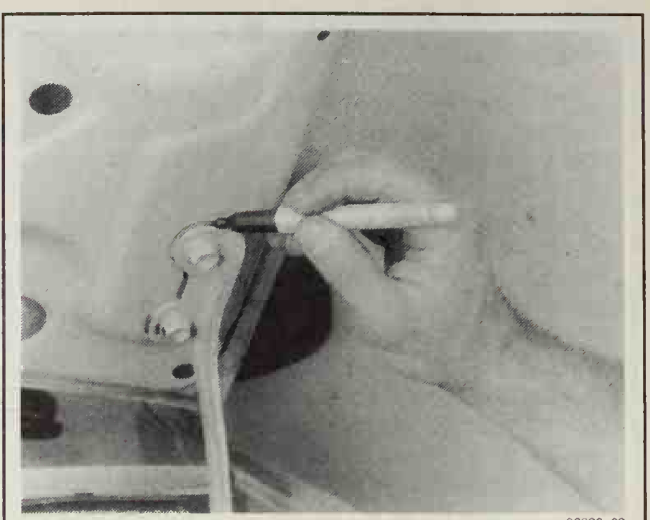


Fig. 5 Matchmark the hood hinges with a marker

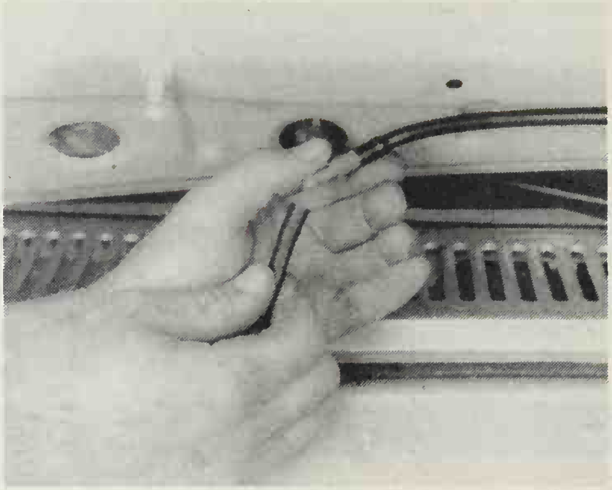


Fig. 6 Don't forget to disconnect the washer hoses

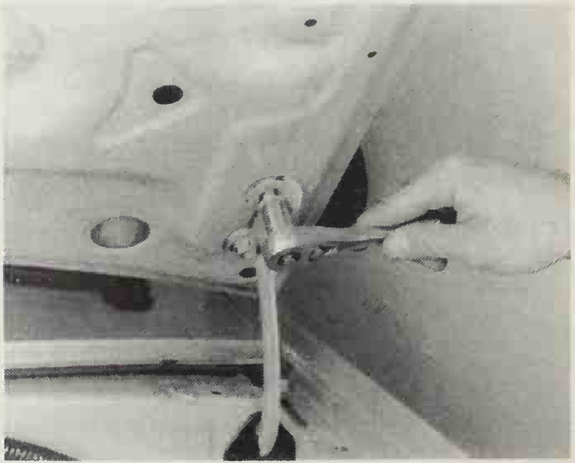


Fig. 7 Unbolt the hinges while an assistant supports the hood

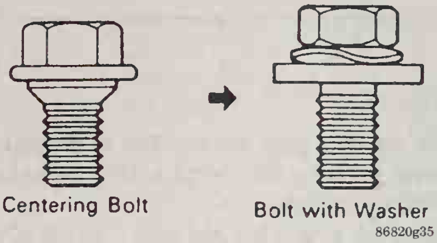


Fig. 8 The centering bolt has no washer and a tapered head; replace it with a washered bolt

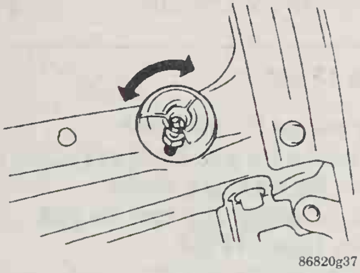


Fig. 10 To raise or lower the front edge of the hood, loosen the cushion screws and turn both cushions — Land Cruiser

1. Loosen the hood to hinge bolts slightly. Adjust the hood fore-and-aft and left-and-right directions. Tighten the bolts to 10-15 ft. lbs. (13-20 Nm).
2. Adjust the front edge of the hood by turning the two cushions higher or lower. The hood should align with the fender edges.
3. Except on the Land Cruiser, remove the wiper arms, then remove the cowl cover below the windshield. Inside the cowl plenum, adjust the hinge-to-body bolts to control the height of the rear of the hood. Reinstall the cowl panel and wipers.
4. On the Land Cruiser, the rear hood height is adjusted by loosening the four mounting screws holding the hinge to the firewall.
5. Loosen the hood latch retaining bolts and adjust the latch by moving it up-down or left-right.
6. Close the hood and check the tension needed to release the hood. If the release requires excessive force, the latch is under tension and must be adjusted.

➡Be sure to tighten all fasteners after the adjustments are complete.

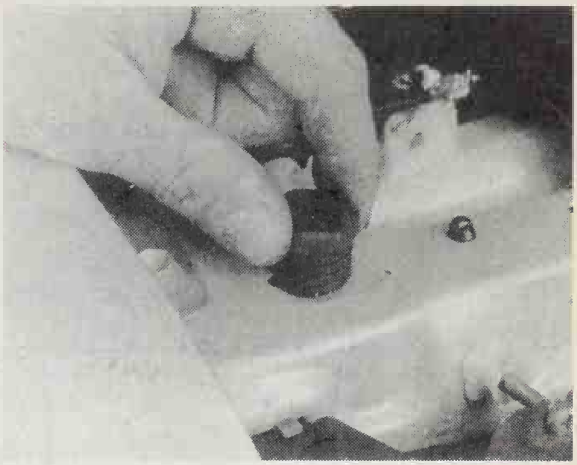


Fig. 11 Most trucks have a ribbed, rubber cylindrical cushion seated on the front of the upper tie bar

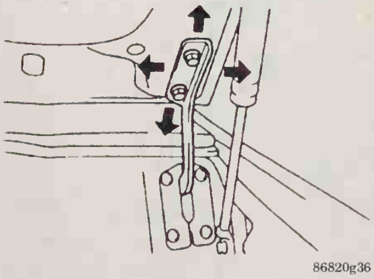


Fig. 9 Adjust the hood in the fore-and-aft and left-and-right directions

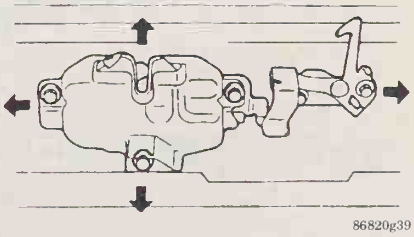


Fig. 12 Loosen the mounting bolts for the hood lock and move it in the necessary direction

Tailgate

REMOVAL & INSTALLATION

➧ **See Figures 13 and 14**

1. Remove the service hole cover.
2. Disconnect the tail gate link from the lock control. If needed, remove the outer gate handle.
3. Remove the tailgate stay from the gate.
4. Unbolt the tailgate hinges.
5. Remove the tailgate and torsion bar.
6. Installation is the reverse of removal.

Rear Door

REMOVAL & INSTALLATION

4Runner

➧ **See Figure 15**

1. Lower the door glass into the door all the way.
2. Remove the bolts and clamps holding the torsion bar to the door. Remove the clip.
3. Remove the torsion bar and bolts from the door. Remove the torsion bar guide.
4. Remove the two bolts and the door stay.
5. Support the door, then remove the hinge bolts and the door.
6. Reinstall in reverse order. Tighten the hinge bolts to 22 ft. lbs. (29 Nm).

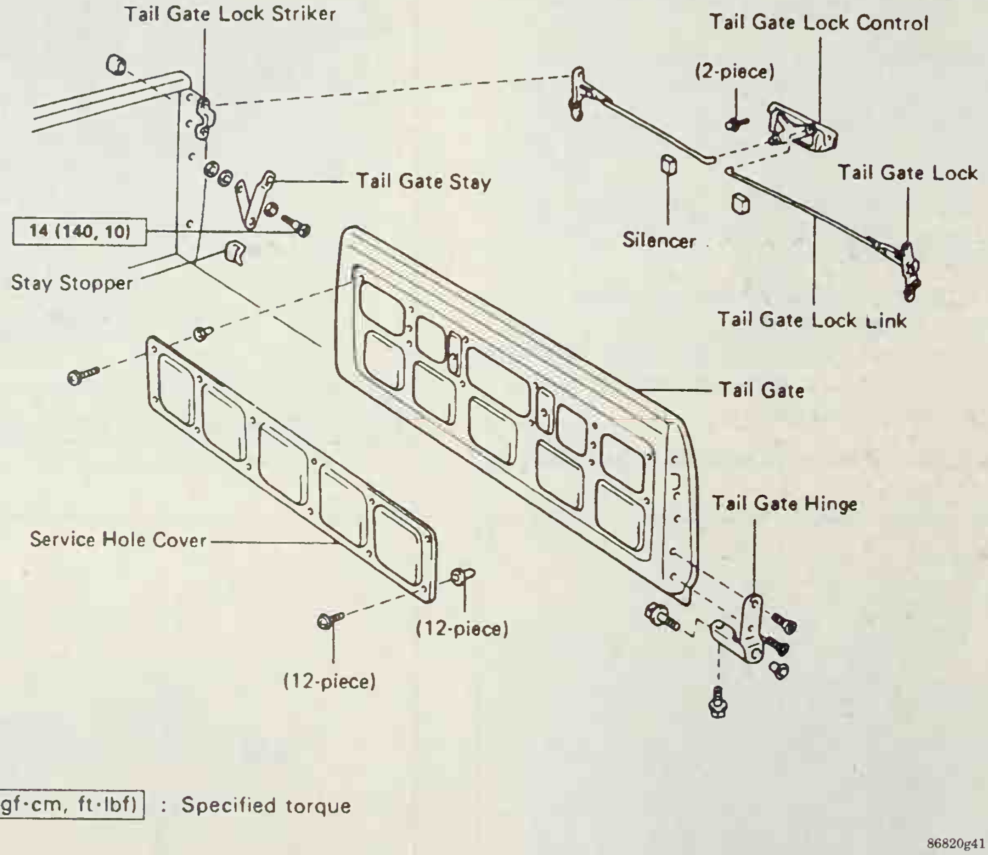

Tail Gate Lock Striker
Tail Gate Lock Control
(2-piece)
Tail Gate Stay
Tail Gate Lock
14 (140, 10)
Silencer
Stay Stopper
Tail Gate Lock Link
Tail Gate
Tail Gate Hinge
Service Hole Cover
(12-piece)
(12-piece)
N·m (kgf·cm, ft·lbf) : Specified torque
86820g41

Fig. 13 Exploded view of the tailgate assembly — Pick-Up

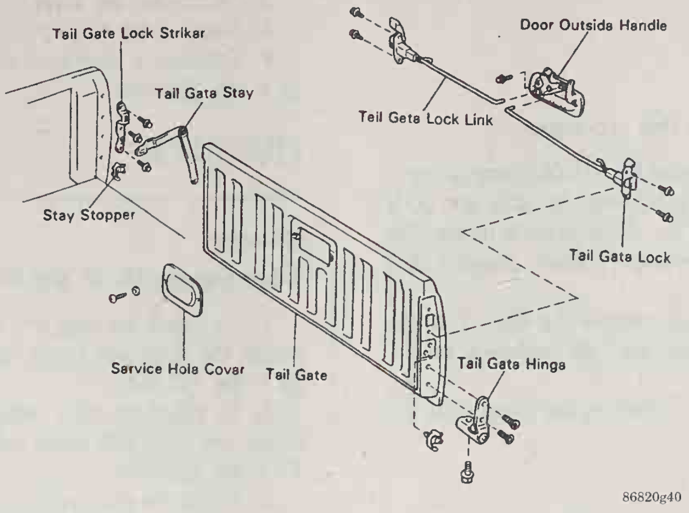

Tail Gate Lock Striker
Tail Gate Stay
Stay Stopper
Door Outside Handle
Tail Gate Lock Link
Tail Gate Lock
Service Hole Cover
Tail Gate
Tail Gate Hinge
86820g40

Fig. 14 Exploded view of the tailgate assembly — T100

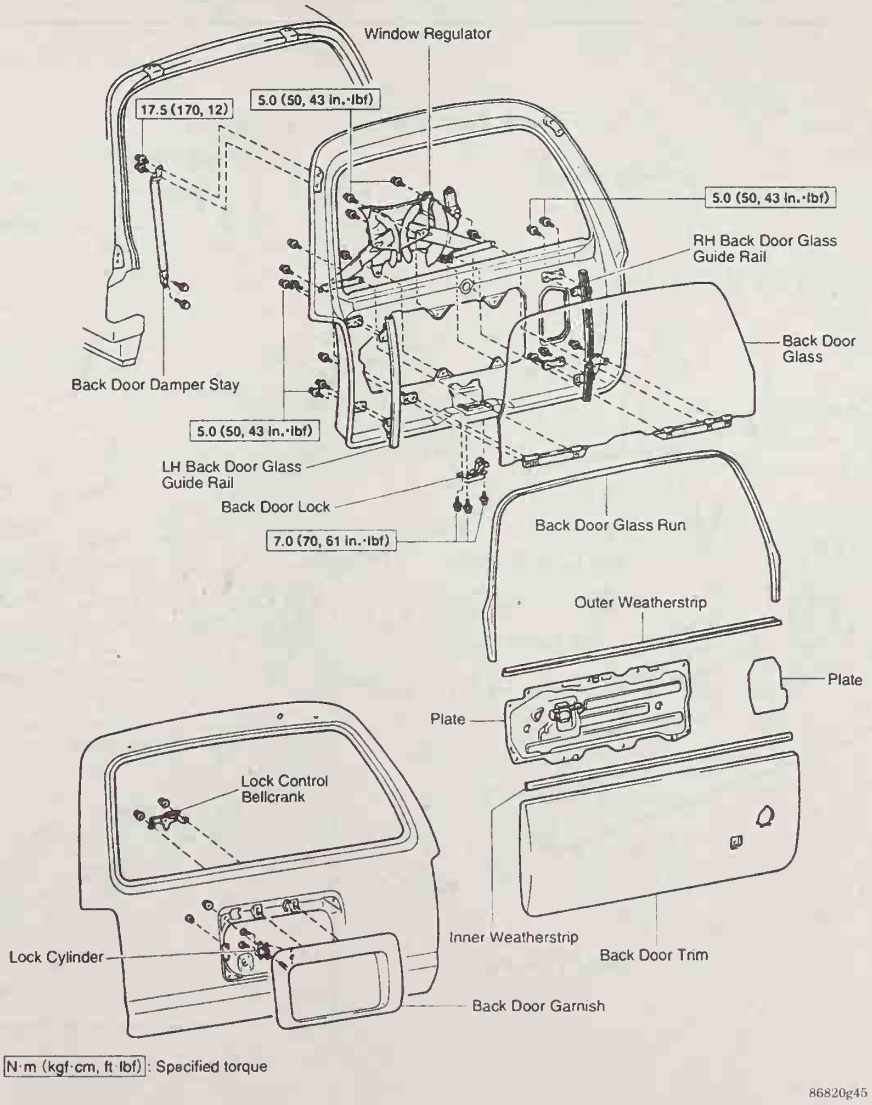

Window Regulator
17.5 (170, 12)
5.0 (50, 43 in.·lbf)
5.0 (50, 43 in.·lbf)
RH Back Door Glass Guide Rail
Back Door Glass
Back Door Damper Stay
5.0 (50, 43 in.·lbf)
LH Back Door Glass Guide Rail
Back Door Lock
7.0 (70, 61 in.·lbf)
Back Door Glass Run
Outer Weatherstrip
Plate
Plate
Lock Control Bellcrank
Lock Cylinder
Inner Weatherstrip
Back Door Trim
Back Door Garnish
N·m (kgf·cm, ft·lbf) : Specified torque
86820g45

Fig. 15 Exploded view of the rear door assembly — 4Runner

Land Cruiser

UPPER DOOR

➧ See Figures 16 and 17

➡An assistant is required for this procedure.

1. Remove the inner door panel trim. Unplug any wiring connectors for harnesses running between the door and body.
2. Remove the bolts holding the door supports to the door.
3. Support the door in a convenient position allowing access to the hinge bolts.
4. Remove the hinge bolts and remove the door. The door is reasonably heavy and not balanced. Use caution when removing or carrying the door.
5. Reinstall in reverse order, tightening the hinge bolts to 22 ft. lbs. (29 Nm.).

LOWER DOOR

1. Remove the inner trim panel.
2. Disconnect the wiring to the license plate light and other electrical equipment.
3. Disconnect the stays.
4. Remove the hinge bolts and remove the door.
5. Reinstall in reverse order, tightening the hinge bolts to 25 ft. lbs. (34 Nm).

ADJUSTMENT

4Runner

➧ See Figures 18, 19 and 20

1. To adjust the door fore-and-aft, as well as left-to-right, loosen the body side hinge nuts. When adjusted, retighten to 25 ft. lbs. (33 Nm).
2. To adjust the door vertically, as well as left-to-right, loosen the door side hinge bolts. When adjusted, retighten to 17 ft. lbs. (23 Nm).
3. Adjust the door striker as follows:
   a. Loosen the striker mounting screws to adjust.
   b. Using a plastic hammer, tap the striker to adjust.

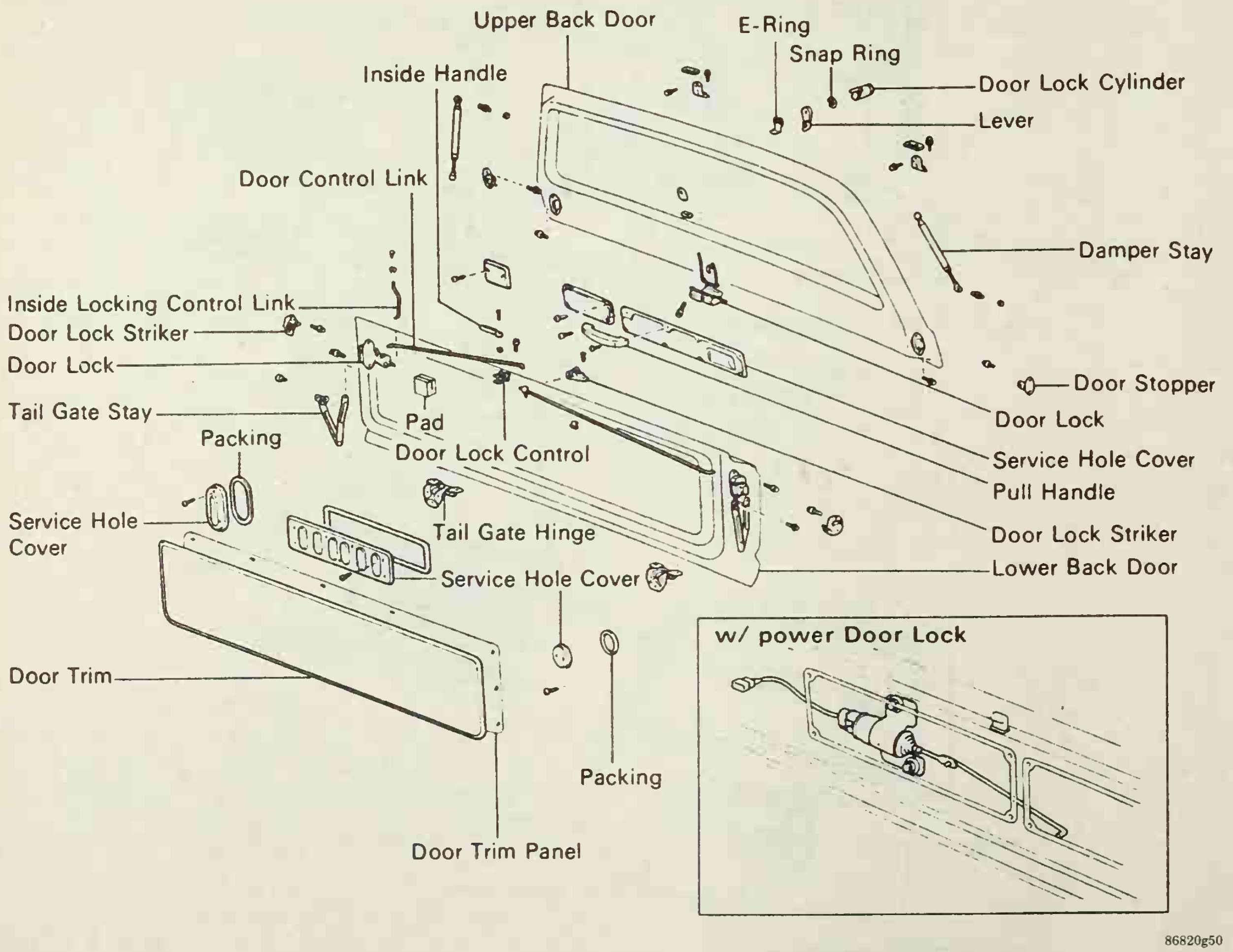

Upper Back Door
E-Ring
Snap Ring
Inside Handle
Door Lock Cylinder
Lever
Door Control Link
Damper Stay
Inside Locking Control Link
Door Lock Striker
Door Lock
Tail Gate Stay
Pad
Door Stopper
Door Lock
Packing
Door Lock Control
Service Hole Cover
Pull Handle
Service Hole Cover
Tail Gate Hinge
Door Lock Striker
Lower Back Door
Service Hole Cover
w/ power Door Lock
Door Trim
Packing
Door Trim Panel
86820g50

Fig. 16 Exploded view of the rear door assembly — 1989-92 Land Cruiser

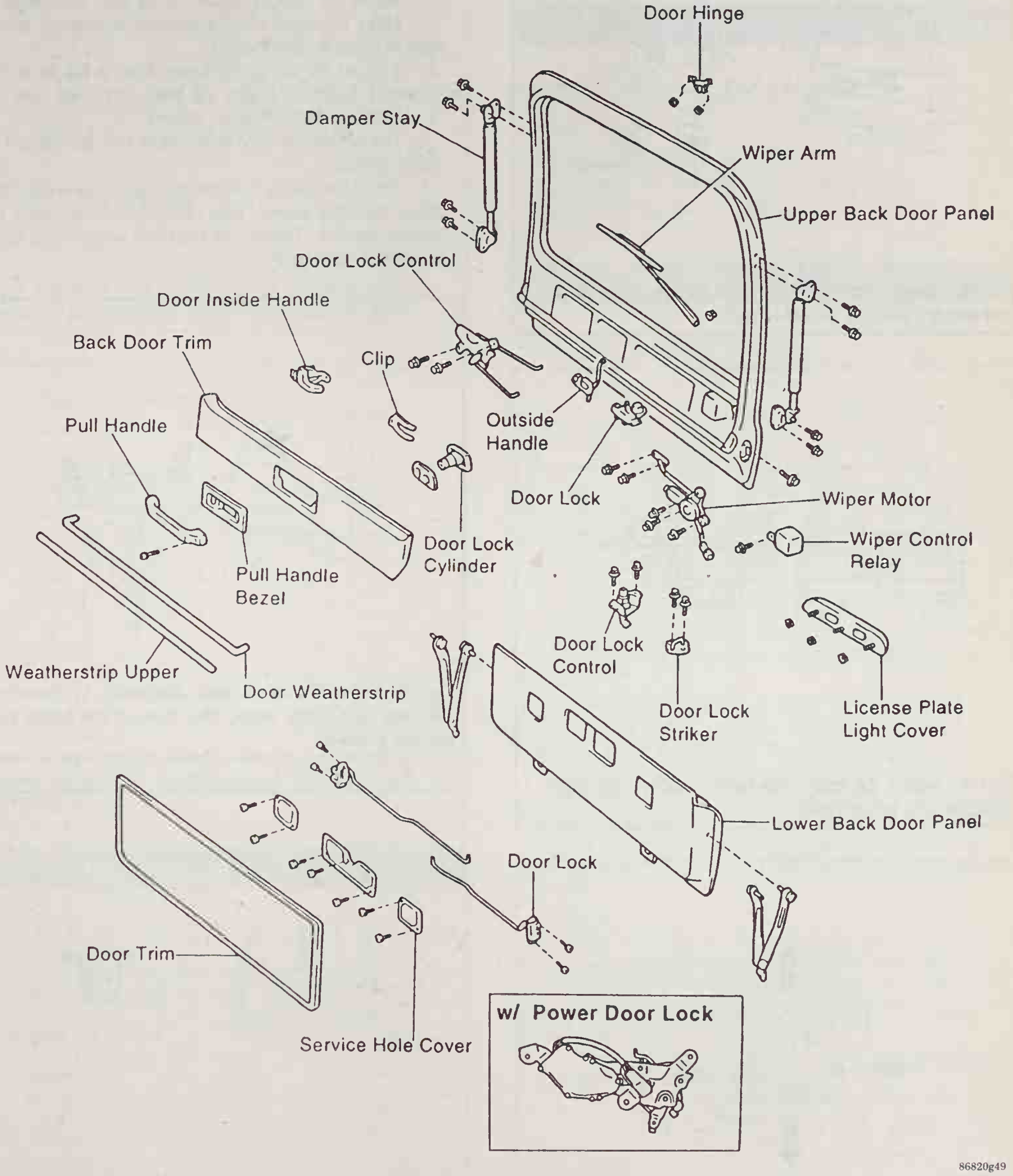

Door Hinge
Damper Stay
Wiper Arm
Upper Back Door Panel
Door Lock Control
Door Inside Handle
Back Door Trim
Clip
Outside Handle
Pull Handle
Door Lock
Wiper Motor
Door Lock Cylinder
Wiper Control Relay
Pull Handle Bezel
Door Lock Control
Weatherstrip Upper
Door Weatherstrip
Door Lock Striker
License Plate Light Cover
Lower Back Door Panel
Door Lock
Door Trim
Service Hole Cover
w/ Power Door Lock
86820g49

Fig. 17 Exploded view of the rear door assembly — 1993-96 Land Cruiser

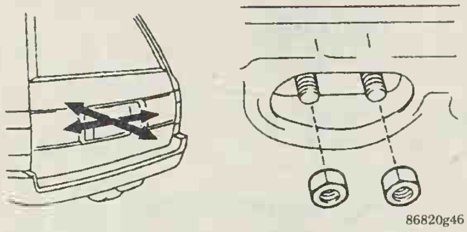


Fig. 18 Loosen the body side nuts to adjust the door fore-and-aft, as well as left-to-right

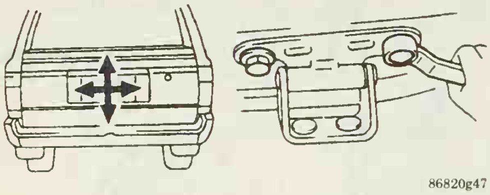


Fig. 19 Loosen the body side bolts to adjust the door vertically and left-to-right

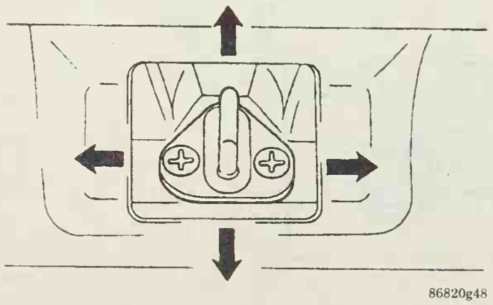


Fig. 20 Loosen the bolts on the striker, then tap with a plastic hammer to adjust

Land Cruiser

➧ See Figures 21, 22, 23 and 24

1. Adjust the upper and lower rear doors fore-and-aft and left-to-right as follows:
   a. Adjust the door by loosening the door side hinge bolts.
   b. Move the hinge into the appropriate direction with your hand or a plastic hammer.
2. To adjust the upper and lower doors in the left-to-right and vertical directions, loosen the body side hinge bolts.
3. Adjust the door striker as follows:
   a. Check that the door fit and door lock linkage are adjusted correctly.
   b. Adjust the striker position by slightly loosening the striker mounting screws, then hitting the striker with a plastic headed hammer. Tighten the mounting screw when the adjustment is appropriate.

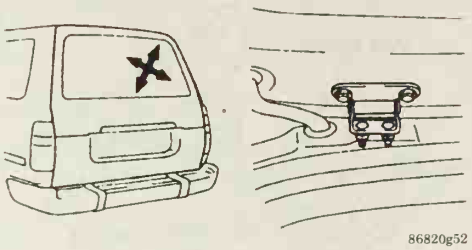


Fig. 21 Adjust the upper door diagonally by loosening the door side hinge bolts, then moving the hinge to the correct position

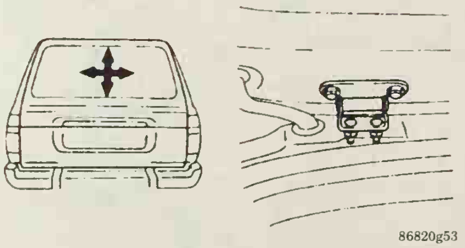


Fig. 22 Adjust the upper door left-to-right and vertically by loosening the body side hinge bolts, then moving the hinge to the correct position

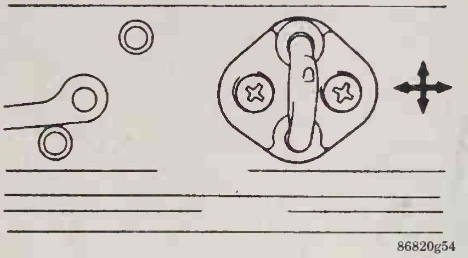


Fig. 23 The door lock striker can be adjusted in each direction of the arrows — upper door striker shown

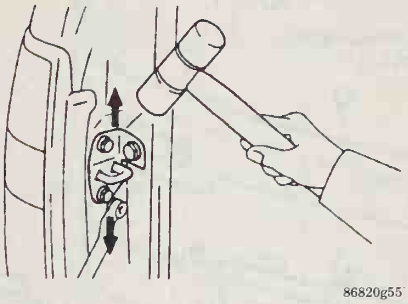


Fig. 24 Using a plastic headed hammer, tap on the striker to adjust it in the direction of the hit — lower door striker shown

Front or Rear Bumper

REMOVAL & INSTALLATION

➧ See Figures 25, 26, 27, 28 and 29

1. Support the bumper.
2. Remove any trim pieces, corner moldings, etc. on the bumper.
3. Remove the nuts and bolts attaching the bumper to the frame.
4. Installation is the reverse of removal.

Grille

REMOVAL & INSTALLATION

1. Open and support the hood.
2. Remove the turn signal and parking lamps.
3. Unscrew the grille assembly.
4. Reverse to install.

Outside Mirrors

REMOVAL & INSTALLATION

The mirrors can be removed from the door without disassembling the door liner or other components. Both left and right outside mirrors may be either manual, manual remote (small lever on the inside to adjust the mirror) or, in some cases, electric remote. If the mirror glass is damaged, replacements may be available through your dealer or a reputable glass shop. If the plastic housing is cracked or damaged, the entire mirror unit must be replaced.

1. If the mirror is manual remote, check to see if the adjusting handle is retained by a hidden screw, usually under an end cap on the lever. If so, remove the screw and remove the adjusting knob.
2. Using a blunt plastic or wooden tool, remove the inner triangular cover from where the mirror mounts to the door. Don't use a screwdriver; the plastic will be marred.
3. Depending on the model and style of mirror, there may be concealment plugs or other minor parts under the cover. Remove them. If electric connectors are present, unplug them.
4. Support the mirror housing from the outside and remove the three bolts or nuts holding the mirror to the door. Remove the mirror.

To install:

5. When installing, fit the mirror to the door, then install the nuts and bolts to hold it. Connect any wiring. Pay particular attention to the placement and alignment of any gaskets or weatherstrips around the mirror; serious wind noises may result from careless work.
6. Install the cover, pressing it firmly into position. Install the control lever knob if it was removed.

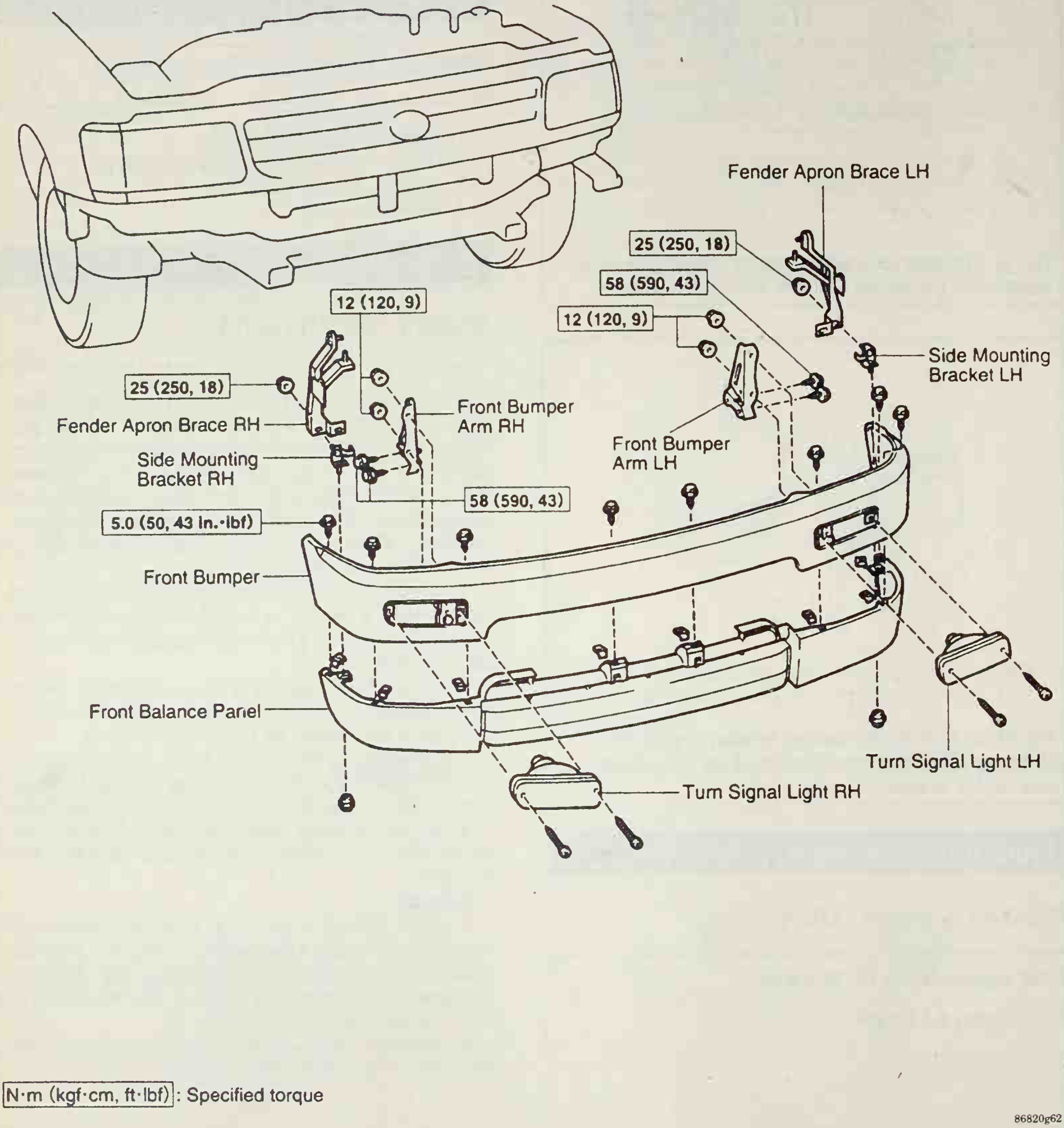

Fender Apron Brace LH
25 (250, 18)
58 (590, 43)
12 (120, 9)
Side Mounting Bracket LH
12 (120, 9)
25 (250, 18)
Fender Apron Brace RH
Front Bumper Arm RH
Front Bumper Arm LH
Side Mounting Bracket RH
58 (590, 43)
5.0 (50, 43 in.-lbf)
Front Bumper
Front Balance Panel
Turn Signal Light LH
Turn Signal Light RH
N·m (kgf·cm, ft·lbf): Specified torque
86820g62

Fig. 25 Exploded view of the front bumper components — 4Runner

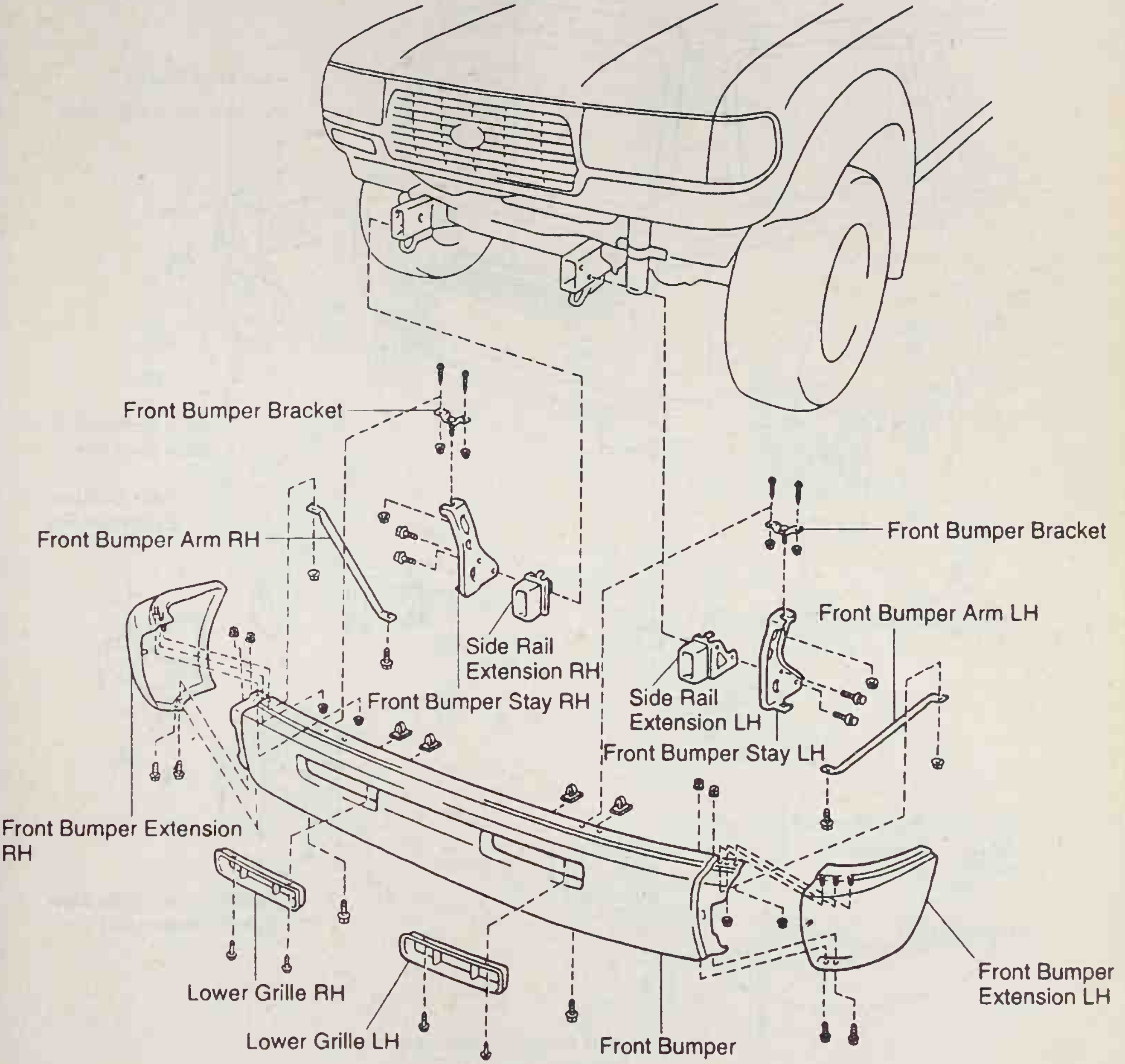

Front Bumper Bracket
Front Bumper Arm RH
Side Rail Extension RH
Front Bumper Stay RH
Front Bumper Extension RH
Lower Grille RH
Lower Grille LH
Front Bumper
Front Bumper Bracket
Front Bumper Arm LH
Side Rail Extension LH
Front Bumper Stay LH
Front Bumper Extension LH
86820g64

Fig. 26 Exploded view of the front bumper components — Land Cruiser

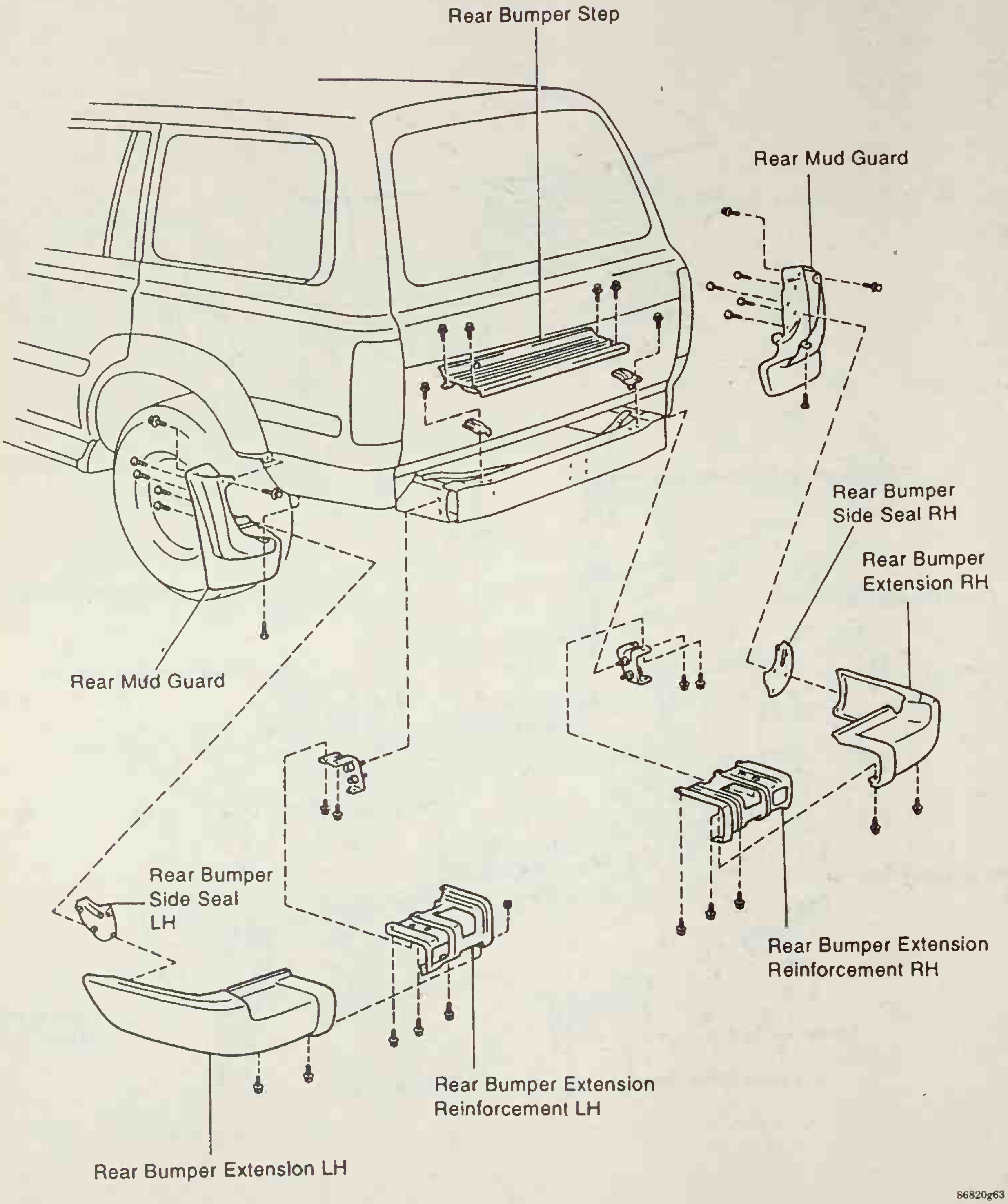

Rear Bumper Step
Rear Mud Guard
Rear Bumper Side Seal RH
Rear Bumper Extension RH
Rear Mud Guard
Rear Bumper Side Seal LH
Rear Bumper Extension Reinforcement RH
Rear Bumper Extension Reinforcement LH
Rear Bumper Extension LH
86820g63

Fig. 27 Exploded view of the rear bumper components — Land Cruiser

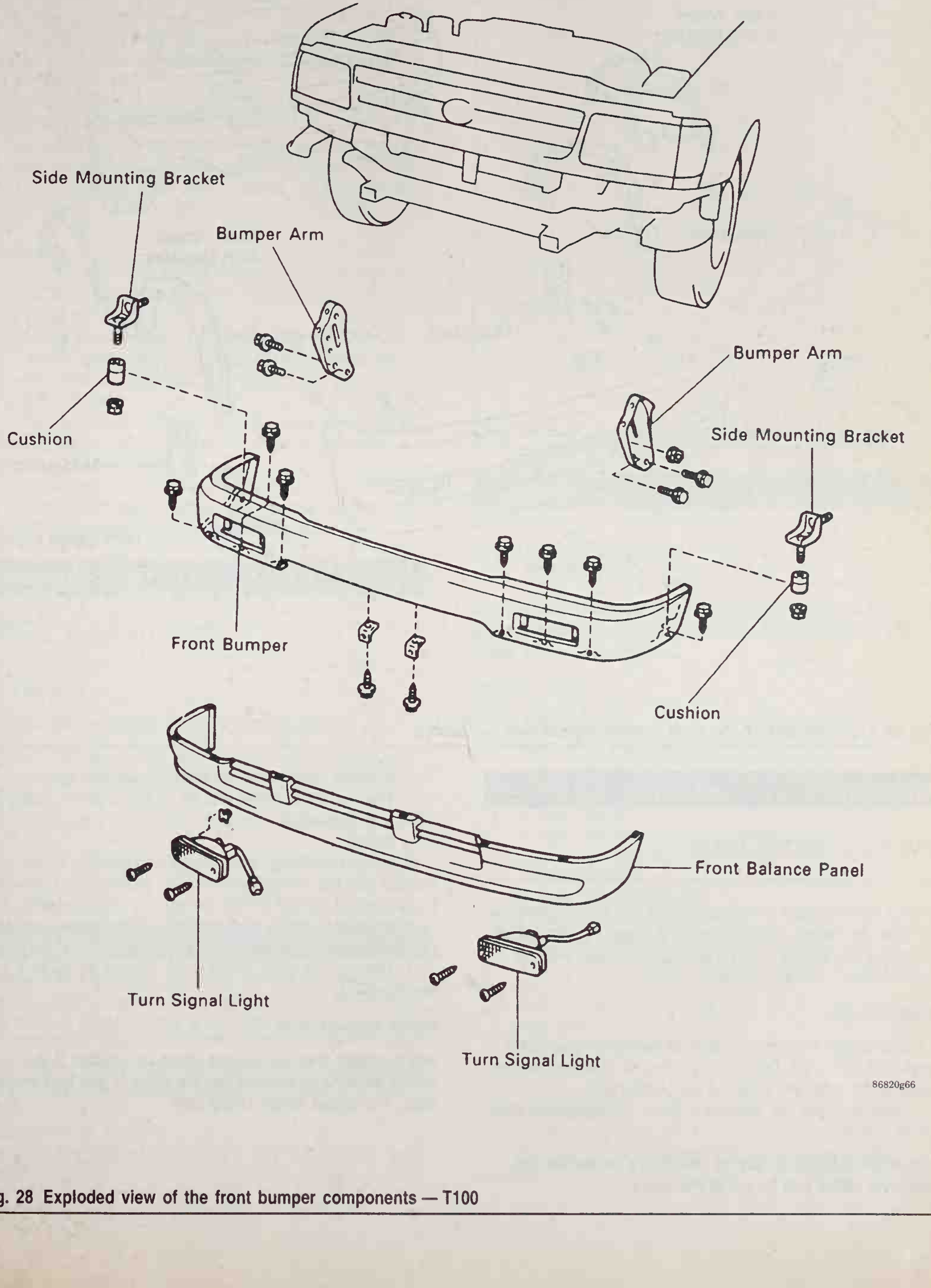

Side Mounting Bracket
Bumper Arm
Bumper Arm
Cushion
Side Mounting Bracket
Front Bumper
Cushion
Front Balance Panel
Turn Signal Light
Turn Signal Light
86820g66

Fig. 28 Exploded view of the front bumper components — T100

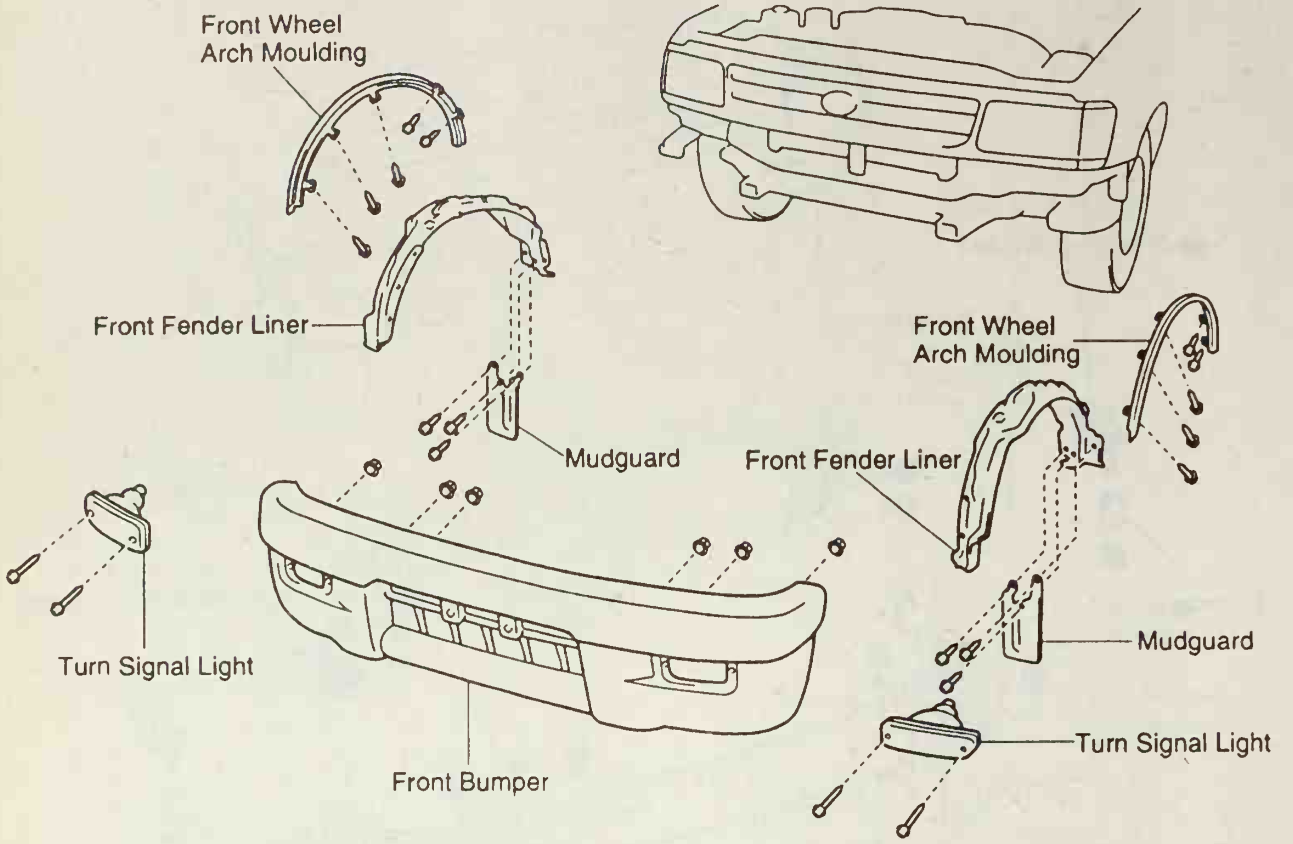

Front Wheel
Arch Moulding
Front Fender Liner
Mudguard
Turn Signal Light
Front Bumper
Front Wheel
Arch Moulding
Front Fender Liner
Mudguard
Turn Signal Light
86820g65

Fig. 29 Exploded view of the front bumper components — Tacoma

Antenna

REMOVAL & INSTALLATION

If your antenna mast is the type where you can unscrew the mast from the fender, simply do so with a pair of pliers. Most damaged antennas are simply the result of a truck wash or similar mishap, in which the mast is bent.

Manual Antenna

1. Disconnect the antenna cable at the radio by pulling it straight out of the set. Depending on access, this may require loosening the radio and pulling it out of the dash.
2. Working under the instrument panel, disengage the cable from its retainers.

➡On some models, it may be necessary to remove the instrument panel pad to get at the cable.

3. Outside, unsnap the cap from the antenna base.
4. Remove the screw(s) and lift off the antenna, pulling the cable with it, carefully.

To install:

5. When reinstalling, make certain the antenna mount area is clean and free of rust and dirt. The antenna must make a proper ground contact through its base to work properly.
6. Install the screws and route the cable into the cab. Make certain the cable is retained in the clips, etc.
7. Connect the cable to the radio; reinstall the radio if it was removed.

Power Antenna Mast

➡The power antenna system contains a relay. If the power antenna is inoperative, the relay is the first place to look. The actual motor rarely fails.

The power antenna mast is replaceable on the Pick-Up and 4Runners. If the mast is damaged or broken, proceed as follows:

1. Perform this repair with the battery cables connected. Turn the ignition switch to the **LOCK** position.
2. Remove the antenna nut.
3. If equipped with a CD player, press the AM and FM buttons on the receiver and simultaneously turn the ignition switch to **ACC**.
4. For non-CD player units, press the AM button and simultaneously turn the ignition switch to **ACC**.
5. The antenna motor will run, unwinding the mast from the spool. have an assistant guide the mast so it doesn't fall and damage the bodywork. When fully extended, the mast will be released. Remove it, and leave the ignition in the **ACC** position.

To install:

6. Insert the new cable so that the teeth face the rear of the vehicle. Feed the cable into the motor until the cable reaches the bottom, about 12 in. (30cm).
7. Have an assistant ready and prepared to guide the cable. Turn the ignition switch to **LOCK**. The motor will run, winding the cable onto the spool and drawing the antenna down into the mount.
8. If the cable does not wind, twist the cable at the top of the housing; the part at the bottom may have turned while being pushed down the hole.
9. Once wound onto the spool, install the antenna nut even if the antenna is not fully retracted. Test the antenna elevation and retraction; the mast will eventually retract fully.

Removable Top

REMOVAL & INSTALLATION

▸ See Figure 30

➥This procedure applies to the 4Runners only.

1. Open the rear window and remove the body garnishes.
2. Disconnect the electrical lead and the hose at the rear washer motor.
3. Remove mounting bolt **B** and then remove the other bolts.
4. Remove the cover and place it on pieces of wood on the ground.

To install:

⁂WARNING

Mounting bolt B controls the cover top switch. When removed, the rear power window cannot be operated. Never install it when the cover top is removed.

5. Position the cover top on the truck body and install bolts **E** and **J**. Install bolts **C** and **L**. Tighten all bolts to 10 ft. lbs. (14 Nm).
6. Loosen bolts **E** and **J**.
7. Install and tighten bolts **D** and **K** and then retighten bolts **E** and **J**.
8. Install all remaining bolts and tighten them to 10 ft. lbs. (14 Nm). Install and tighten bolt **B**.
9. Connect the washer motor lead and hose, install the garnishes and close the tailgate. Check for proper operation of the rear window.

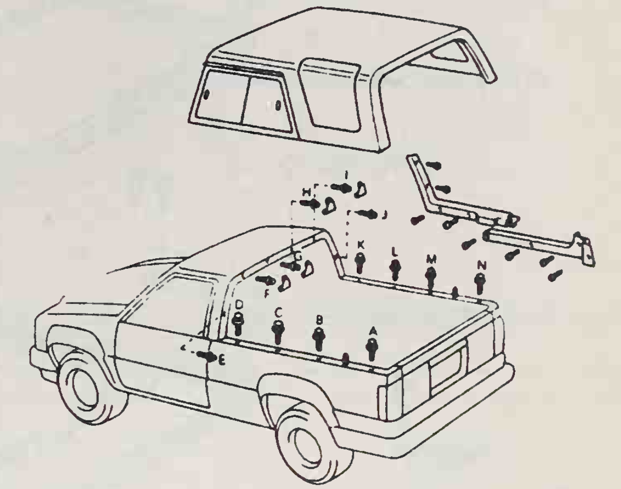


Fig. 30 Bolt locations on the 4Runner removable roof

Sunroof

REMOVAL & INSTALLATION

➥When removing any interior garnish pieces, always have a small supply of extra clips on hand. You will very likely break a few upon removal.

4Runner

▸ See Figure 31

1. Remove the following parts:
   - Rear room light
   - Back door scuff plate
   - Rear header trim
   - Back and rear doors scuff plates
   - Rear seat side garnish
   - Deck side trim
   - Front door scuff plate
   - Center pillar lower garnish
2. Unbolt the front seat belt shoulder anchor.
3. Using a taped flat-bladed tool, remove the center pillar upper garnish.
4. Remove the following parts:
   - Assist grips
   - Front pillar garnish
   - Control switch
   - Inner rear view mirror
   - Front room lamp
   - Sunvisors and holders
5. Remove the clips securing the headliner. Lower the headliner.

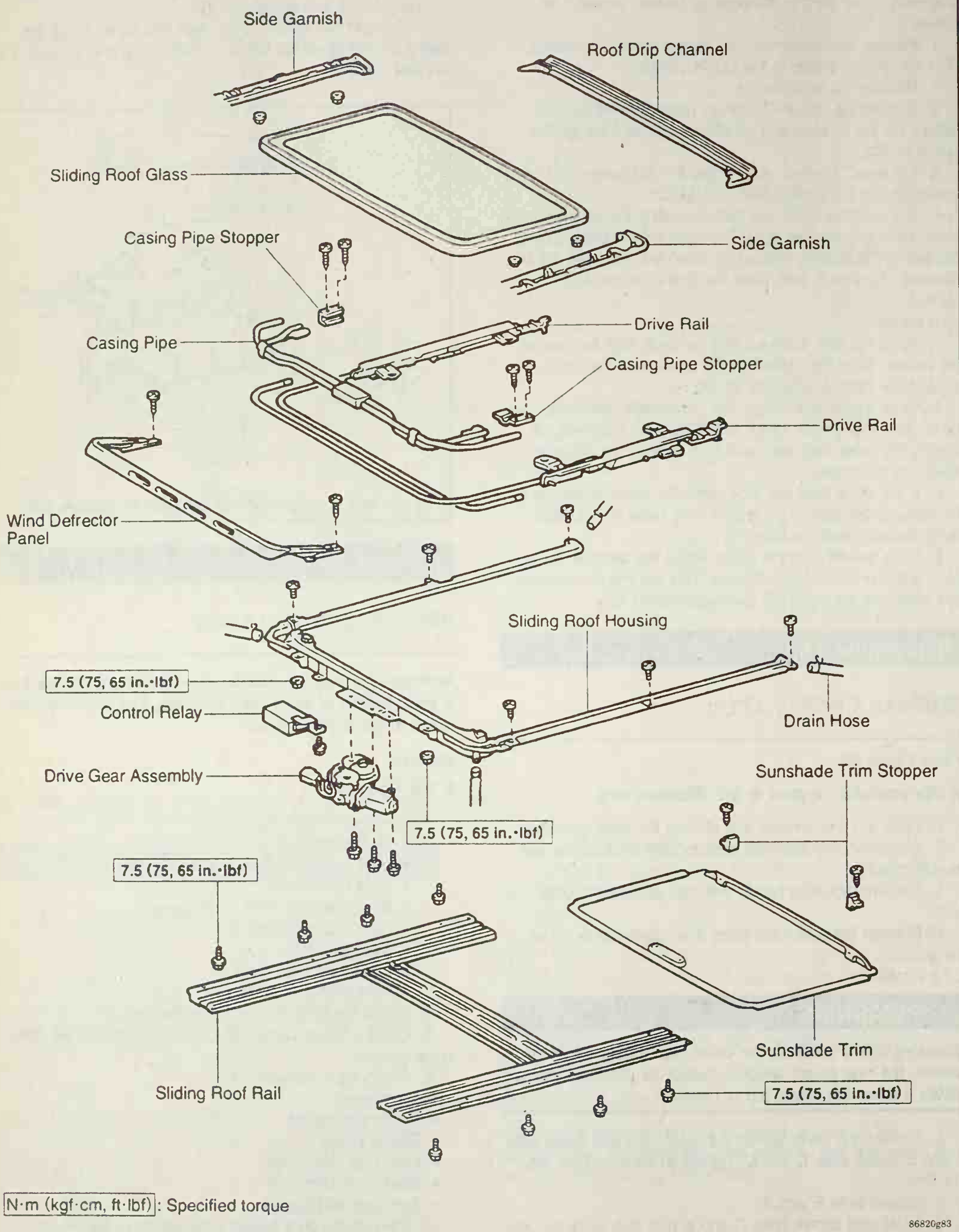

Side Garnish
Roof Drip Channel
Sliding Roof Glass
Casing Pipe Stopper
Side Garnish
Casing Pipe
Drive Rail
Casing Pipe Stopper
Drive Rail
Wind Defractor Panel
Sliding Roof Housing
7.5 (75, 65 in.·lbf)
Control Relay
Drain Hose
Drive Gear Assembly
Sunshade Trim Stopper
7.5 (75, 65 in.·lbf)
7.5 (75, 65 in.·lbf)
Sunshade Trim
Sliding Roof Rail
7.5 (75, 65 in.·lbf)
N·m (kgf·cm, ft·lbf): Specified torque
86820g83

Fig. 31 Exploded view of the sliding roof components — 4Runner

6. Unplug the drain hoses and connectors. Remove the nuts and bolts and roof housing assembly.
7. Reinstall in reverse order. Tighten the housing assembly bolts to 65 inch lbs. (7 Nm) and the seat belt shoulder anchor to 31 ft. lbs. (42 Nm).

Land Cruiser

➧ See Figures 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44 and 45

1. Remove the following parts:
    - Back door scuff plate
    - Rear seat
    - Right and left quarter side trims
    - Rear seat side garnish
    - Rear door scuff plate
    - Cowl side trim
    - Front and rear door opening trims
    - Center pillar lower garnish
    - Front seat outer belt shoulder anchor
    - Center pillar upper garnish
    - Front seat outer belt shoulder anchor adjuster
    - Both rear seat outer belt shoulder anchors
    - Quarter pillar garnish
    - Rear pillar garnish
    - Assist grips
    - Front pillar garnish and sunvisors with holders
    - Inner rear view mirror
    - Front and rear room lamps
    - Back door opening trim
    - Sliding roof opening moulding
2. Remove the control switch by unscrewing the cover. Separate the cover from the body, then unscrew the switch body. Unplug the connector. Remove the body with bracket.
3. Remove the clips retaining the headliner.
4. Unbolt the drive gear control relay, then unplug the connector.
5. Remove the gear mounting bolts and bracket. Separate the drive gear from the unit then unplug the connector.
6. Remove the sliding roof garnishes. Pry loose the inner side garnish clips.
7. Remove the sliding roof glass. Remove the nuts and shims. Be sure your have all six of the shims. Pull the glass upwards to remove it from the vehicle.
8. Remove the drip channel.
9. Remove the wind deflector.
10. Disconnect the drain hose, then remove the roof housing.
11. Adjust the drive rail to a closed and tilted down position. Using a flat-bladed tool, slide the link forward or backward to align the 2 marks shown in the illustration.

To install:

12. Adjust and install the the drive gear assembly as follows:
    a. Remove the screw and cam plate cover.
    b. Remove the large screw, washers and shim.
    c. Turn the driveshaft with a screwdriver to align the housing and gear point mark.
    d. Install the cam plate cover with the screw.
    e. Install the drive gear assembly with the four mounting bolts.
    f. Plug in the connector.

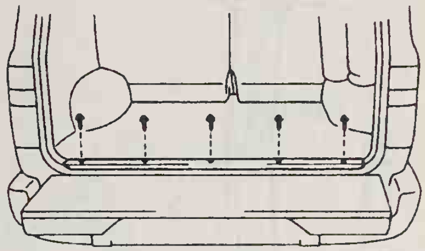


Fig. 32 Remove the mounting screws for the back door inner scuff plate

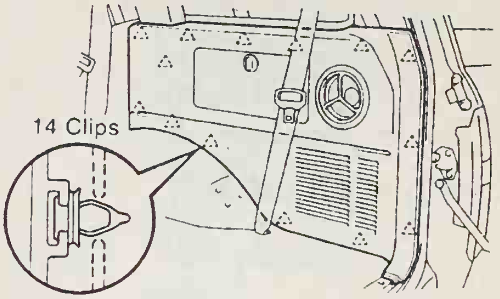


Fig. 33 When prying the quarter trim, try not to damage the panel

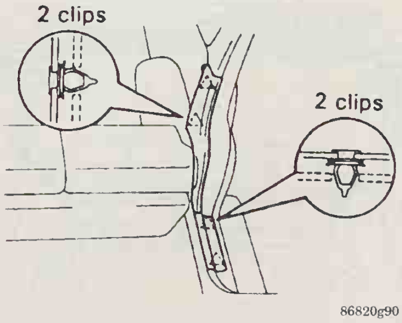


Fig. 34 The rear seat garnish is located along the side where your knee would hit while sitting in the vehicle

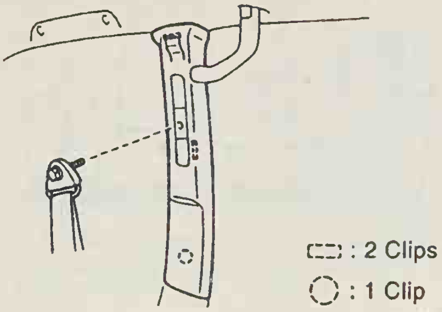

: 2 Clips
: 1 Clip
86820g91

Fig. 35 The bolt anchor is the top mounting bolt for the retractor

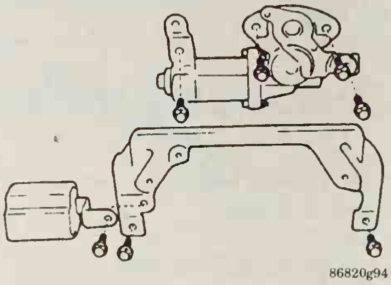


Fig. 38 The drive gear assembly and relay are bolted onto a bracket

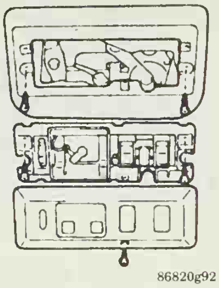


Fig. 36 The control switch is removed as three separate parts

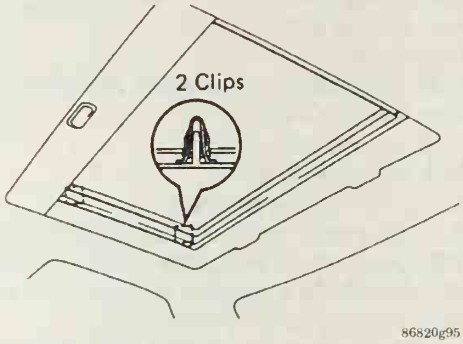

2 Clips
86820g95

Fig. 39 There are two clips retaining the sliding roof garnish

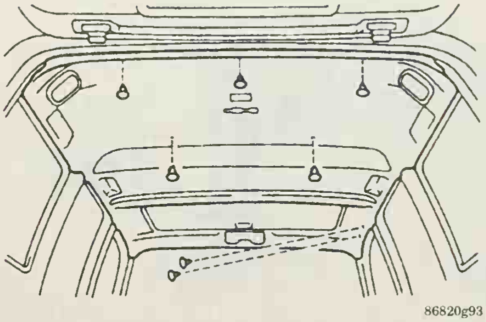


Fig. 37 When removing the headliner, be sure to lay it somewhere where it will not be stepped on

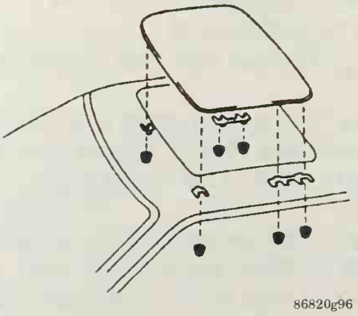


Fig. 40 Remove the nuts and shims from the glass, then pull the glass up and out

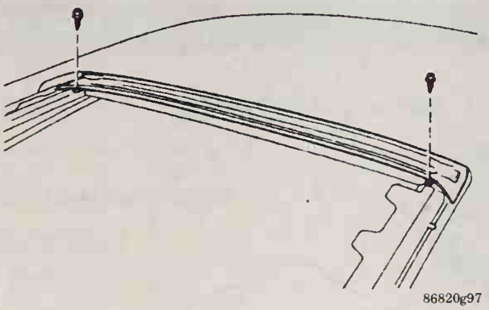


Fig. 41 Unscrew the drip channel

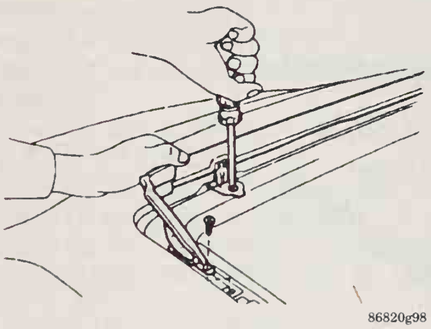


Fig. 42 Remove the wind deflector mounting screws, then lift it up and out of the vehicle

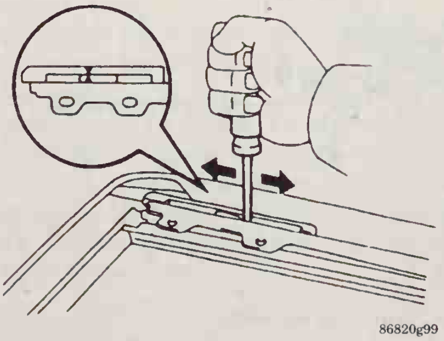


Fig. 43 Using a flat-bladed tool, slide the link forward or backward to align the 2 marks as shown in the inset

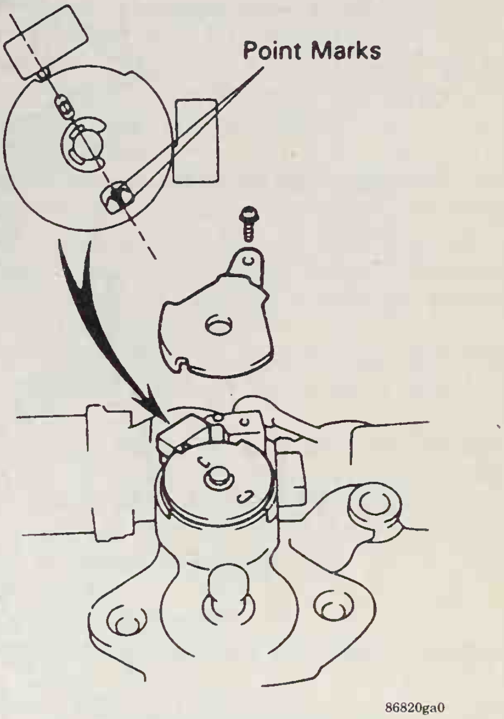


Fig. 44 Turn the driveshaft with a screwdriver to align the housing and gear point mark of the drive gear assembly

13. Install the drive gear control relay and bracket, then attach the connector.
14. Install the remaining parts in the reverse order of removal.

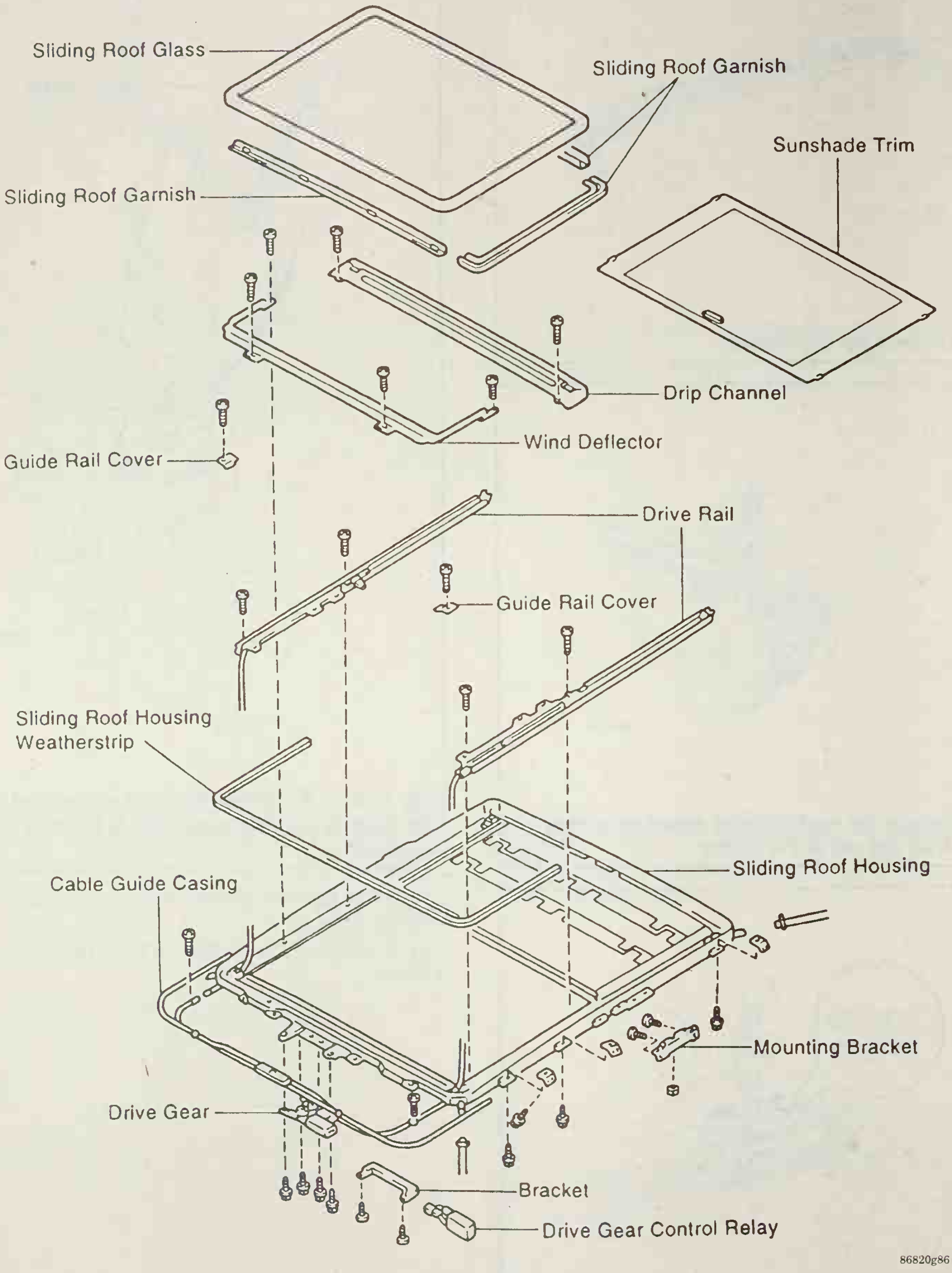

Sliding Roof Glass
Sliding Roof Garnish
Sunshade Trim
Sliding Roof Garnish
Drip Channel
Wind Deflector
Guide Rail Cover
Drive Rail
Guide Rail Cover
Sliding Roof Housing
Weatherstrip
Sliding Roof Housing
Cable Guide Casing
Mounting Bracket
Drive Gear
Bracket
Drive Gear Control Relay
86820g86

Fig. 45 Exploded view of the sliding roof components — Land Cruiser

INTERIOR

Instrument Panel

REMOVAL & INSTALLATION

Pick-Up and 4Runner

1989-95 MODELS

➧ See Figures 46 and 47

1. Disconnect the negative battery cable.

⁂CAUTION

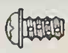
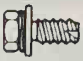
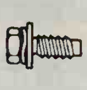
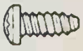
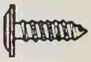
The air bag system (SRS) must be disarmed before removing the steering wheel. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

2. Remove the steering wheel.
3. Remove the upper and lower steering column covers.
4. Remove the hood release lever from the panel. It's held by two screws.
5. Remove the cowl side trim on each side. You might refer to it as the kick panel.
6. Remove the lower center instrument panel cover.
7. Remove the ignition key cylinder cover.
8. Remove the No. 1 lower finish panel; this is the panel holding the left speaker and running under the steering column.
9. Remove the heater duct to No. 2 outlet.
10. Pull off the heater control knobs, remove the A/C switch if equipped and gently pry up on the heater control unit to remove it. The prying tool should have a taped or protected edge.
11. For all models except Pick-Ups with 4 speed manual transmissions, remove the 3 screws holding the meter trim. Pull the trim or surround panel outward and unplug the connectors. On 4Runner, remove the two screws and the cup holder from the panel.
12. For Pick-Ups with 4 speed manual transmissions, the trim is held only by two screws. Unplug the connectors and remove the trim panel.
13. Remove the No.1 air outlet. It's attached with 2 screws.
14. Remove the four screws holding the combination meter. Work it out of the panel until access is gained to the rear. Disconnect the speedometer cable and remove the electrical connectors. Remove the meter assembly, placing it in a safe location out of the work area.
15. Remove the lower trim panel with the glove box door attached. The panel is held by 4 screws and 1 bolt.
16. Remove one bolt holding the lower center finish panel (around the radio and heater controls) and remove the panel.
17. Remove the heater control assembly. Don't forget to disconnect each control cable at the heater box. Withdraw the cables through the dash with the controller.
18. Remove the radio.
19. Remove the bolts holding the instrument panel and the entire panel assembly. Because of the nature of the rear clips, lift the panel upward at an angle. It will come loose with various items still attached; disconnect the wiring harnesses as soon as easily reached. An assistant is useful due the awkward size and location of the panel.
20. Once removed from the vehicle, the safety pad, heater ducts and assorted brackets may be removed if desired.

To install:

21. Assemble the instrument panel, safety pad and other items removed. Fit the panel into place, connect the wiring and secure the retaining bolts. Make certain the panel is flush and level. The heater vent ducts must match up exactly with no leaks. Make any needed adjustments now.
22. Install the radio.
23. Install the heater controls.
24. Install the lower center finish panel. Don't forget the screw.
25. Install the No.2 lower trim panel with the glove box door.
26. Place the combination meter loosely in place and connect the speedometer cable and wiring harnesses. Fit the meter into place and install the retaining screws.
27. Bolt down the left air outlet.
28. Install the meter hood and finish panel. Install the screws and make certain all the vents and ductwork align. Check that each wiring connector is correctly placed.
29. Install the heater control trim plate.
30. Connect the air duct to air outlet No. 2.
31. Attach the No. 1 lower finish panel.
32. Install the ignition key cylinder cover.
33. Install the lower center instrument panel cover.
34. Attach the cowl side trim (kick panels).
35. Secure the hood release and bracket.
36. Install the steering column covers.
37. Install the steering wheel.
38. Connect the negative battery cable.
39. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

Models Ex. 4-Speed M/T

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
A		φ = 5 (0.20) L = 14 (0.55)	B		φ = 6 (0.24) L = 22 (0.87)	C		φ = 5 (0.20) L = 18 (0.71)
D		φ = 5 (0.20) L = 16 (0.63)	E		φ = 5 (0.20) L = 16 (0.63)			

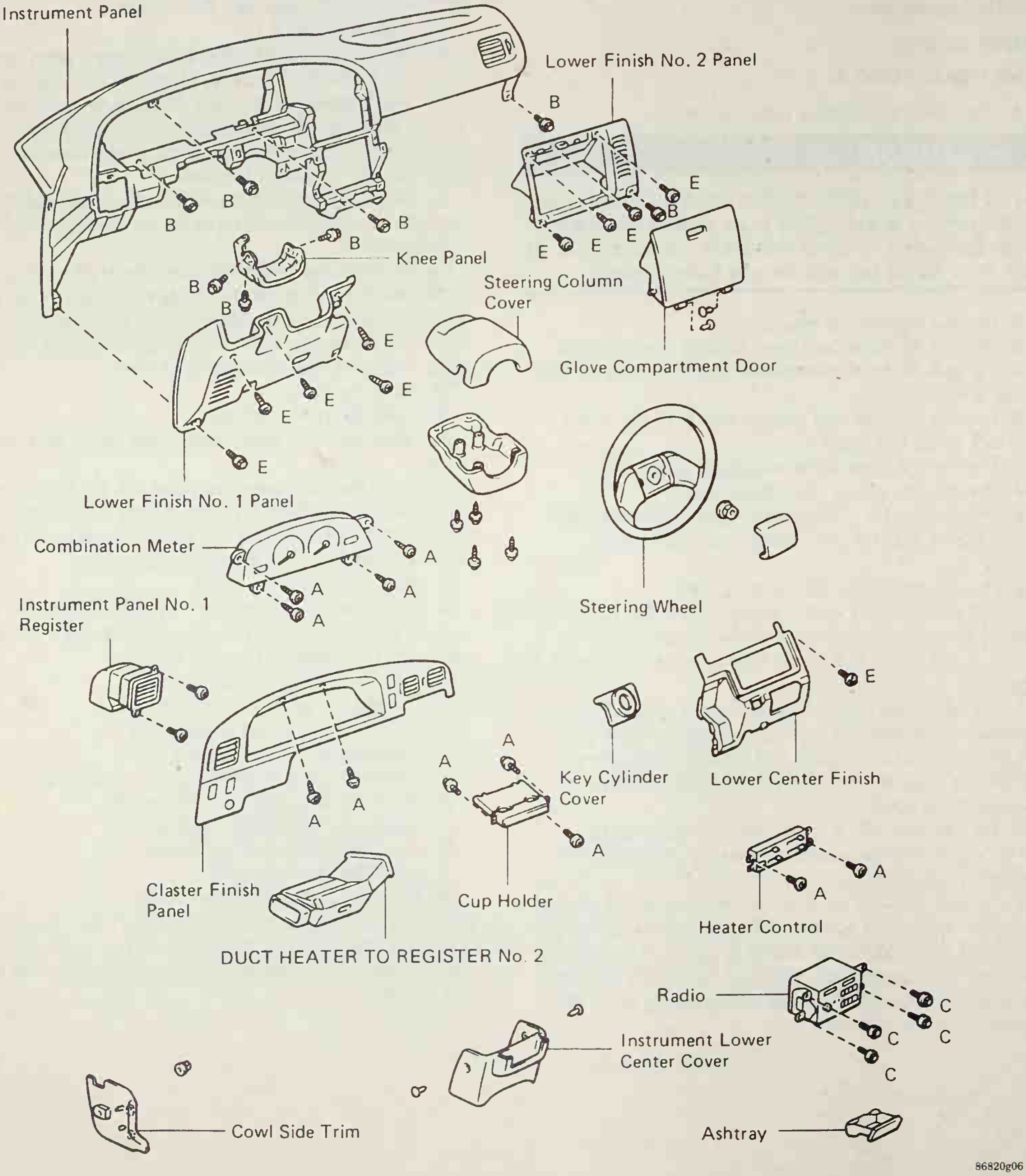
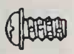
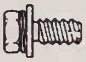
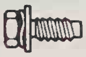
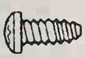
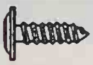
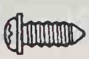

Instrument Panel
Lower Finish No. 2 Panel
B
B
B
B
B
E
B
E
E
E
B
Knee Panel
B
B
Steering Column Cover
E
E
E
E
E
Glove Compartment Door
Lower Finish No. 1 Panel
Combination Meter
A
A
A
A
Steering Wheel
Instrument Panel No. 1 Register
E
A
A
A
A
Key Cylinder Cover
Lower Center Finish
A
A
A
Claster Finish Panel
Cup Holder
Heater Control
DUCT HEATER TO REGISTER No. 2
Radio
C
C
C
C
Instrument Lower Center Cover
Cowl Side Trim
Ashtray
86820g06

Fig. 46 Exploded view of the instrument panel and related components — 1989-95 Pick-Ups and 4Runners except with 4-speed manual transmission

4-Speed M/T Models

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
A		$\phi = 5$ (0.20) L = 14 (0.55)	B		$\phi = 6$ (0.24) L = 22 (0.87)	C		$\phi = 5$ (0.20) L = 18 (0.71)
D		$\phi = 5$ (0.20) L = 16 (0.63)	E		$\phi = 5$ (0.20) L = 16 (0.63)	F		$\phi = 5$ (0.20) L = 14 (0.55)

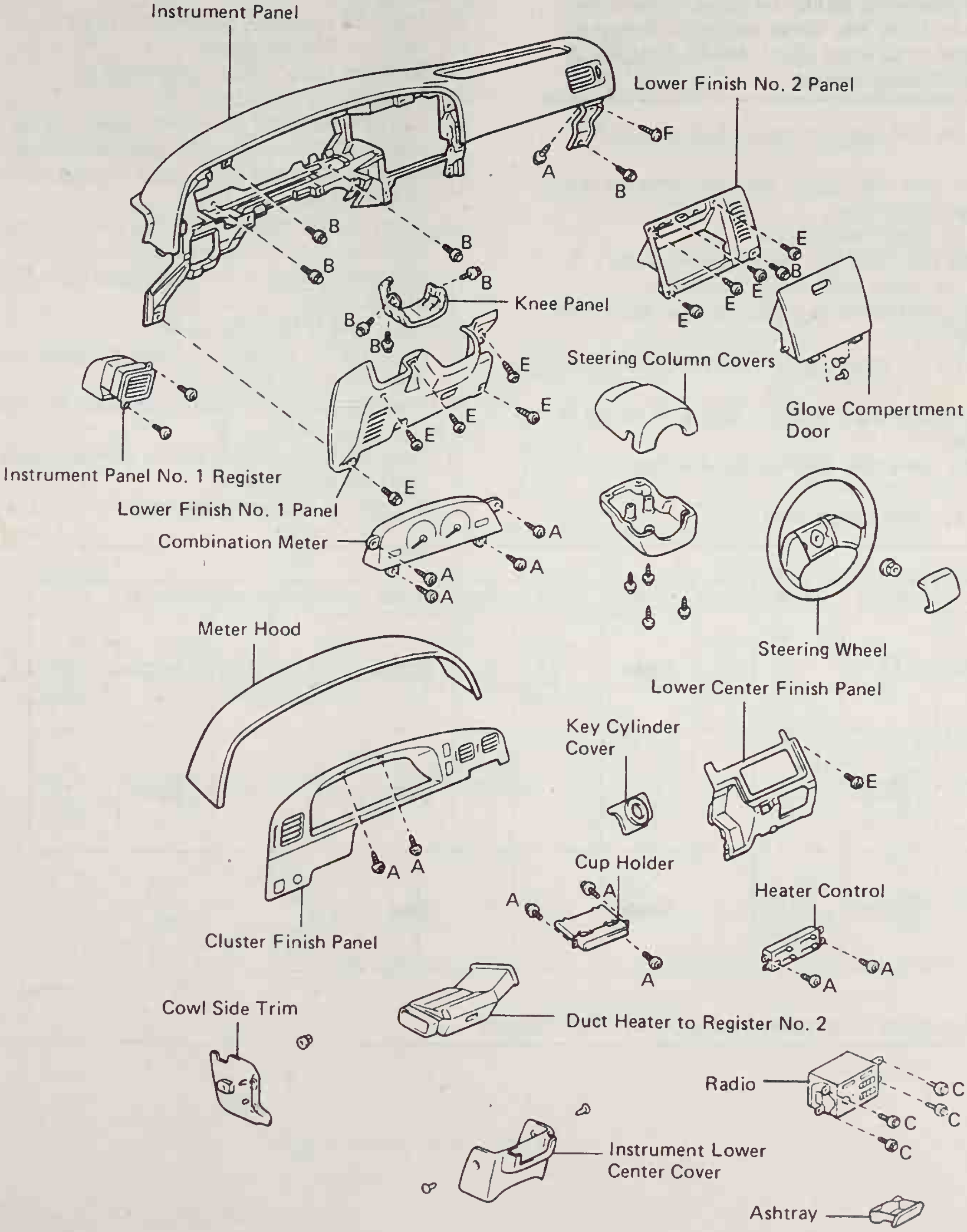

Instrument Panel
Lower Finish No. 2 Panel
F
A
B
B
B
B
B
Knee Panel
B
B
E
E
E
E
E
E
E
E
B
Steering Column Covers
Glove Compertment Door
Instrument Panel No. 1 Register
Lower Finish No. 1 Panel
E
Combination Meter
A
A
A
A
Steering Wheel
Meter Hood
Lower Center Finish Panel
Key Cylinder Cover
E
A
A
Cluster Finish Panel
Cup Holder
A
A
A
Heater Control
A
A
Cowl Side Trim
Duct Heater to Register No. 2
Radio
C
C
C
C
Instrument Lower Center Cover
Ashtray
86820g07

Fig. 47 Exploded view of the instrument panel and related components — 1989-95 Pick-Ups and 4Runners with 4-speed manual transmission

1996 MODELS

➧ See Figures 48, 49 and 50

1. Disconnect the negative battery cable.
2. Remove the steering wheel.

⁂CAUTION

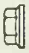
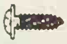
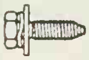
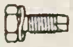
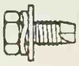
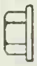
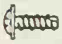
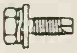
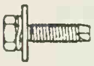
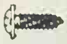
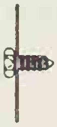
The air bag system (SRS) must be disarmed before removing the steering wheel or instrument panel. Refer to Section 6. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Remove the cowl side trim and the front door scuff plate.
4. Unbolt the lower finish panel, then remove the hood and fuel tank release lever screws.
5. Remove the starter switch bezel.
6. Detach the No. 2 and No. 1 heater-to-register duct.
7. Unscrew the cluster finish panel, then remove.
8. Disconnect the harness for the combination meter, then unscrew and remove.
9. Remove the A/C switch, heater control knob and heater control panel.
10. Remove the 2 mounting screws. Using a flat bladed tool, remove the panel.
11. Unplug the connectors. Separate the A/C control cable from the unit.
12. Remove the glove compartment door.
13. Remove the glove box lamp. Remove the bolts and the panel.
14. Remove the glove compartment door reinforcement.
15. Unhook the heater register duct. Remove the radio and side bracket.
16. Disconnect the air bag harness.
17. Remove the bolts in the upper portion of the glove box.
18. Remove the defroster nozzle.
19. Remove the instrument panel reinforcement.

To install:

20. Attach the instrument panel reinforcement.
21. Install the defroster nozzle.
22. Bolt in the upper portion of the glove box.
23. Plug in the air bag harness.
24. Install the radio and hook-up the heater register duct.
25. Install the glove compartment door reinforcement.
26. Install the glove box lamp. Attach the bolts for the panel.
27. Install the glove box door.
28. Attach the A/C control cable. Plug the connectors.
29. Install the center cluster finish panel.
30. Attach the harness to the combination meter, then attach to the vehicle.
31. Tighten the cluster finish panel.
32. Attach the No. 2 and No. 1 heater-to-register duct.
33. Install the starter switch bezel.
34. Install the lower finish panel, then attach the hood and fuel tank release lever.
35. Install the cowl side trim and the front door scuff plate.
36. Install the steering wheel.
37. Connect the negative battery cable.

mm (in.)

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
Ⓐ		–	Ⓑ		ϕ = 5.22 (0.21) L = 16 (0.63)	Ⓒ		ϕ = 6 (0.24) L = 22 (0.87)	Ⓓ		ϕ = 6 (0.24) L = 16 (0.63)
Ⓔ		ϕ = 8 (0.31) L = 18 (0.71)	Ⓕ		–	Ⓖ		ϕ = 5 (0.20) L = 14 (0.55)	Ⓗ		ϕ = 6 (0.24) L = 18 (0.71)
Ⓘ		ϕ = 6 (0.24) L = 24 (0.94)	Ⓙ		ϕ = 5 (0.20) L = 16 (0.63)	Ⓚ		ϕ = 6 (0.24) L = 16 (0.63)			

86820g11

Fig. 48 Various types of instrument panel bolts — 1996 4Runner

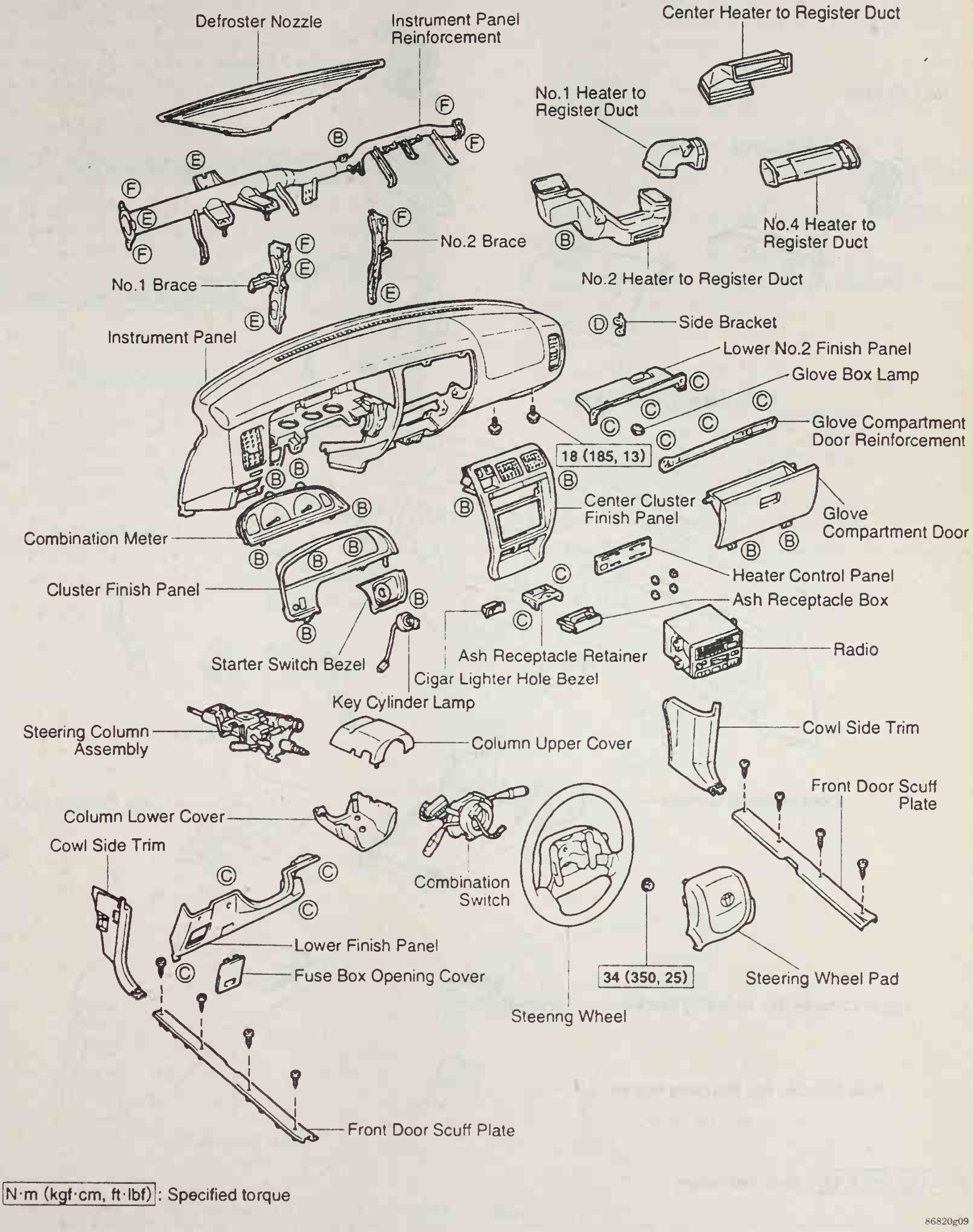

Defroster Nozzle
Instrument Panel Reinforcement
Center Heater to Register Duct
No.1 Heater to Register Duct
F
B
E
F
E
F
F
F
E
E
No.2 Brace
No.4 Heater to Register Duct
B
No.2 Heater to Register Duct
No.1 Brace
E
Instrument Panel
D
Side Bracket
Lower No.2 Finish Panel
Glove Box Lamp
C
C
C
C
C
C
Glove Compartment Door Reinforcement
18 (185, 13)
B
B
B
B
Center Cluster Finish Panel
Glove Compartment Door
Combination Meter
B
B
B
B
B
Heater Control Panel
Cluster Finish Panel
C
Ash Receptacle Box
B
C
B
Radio
Starter Switch Bezel
Ash Receptacle Retainer
Cigar Lighter Hole Bezel
Key Cylinder Lamp
Steering Column Assembly
Column Upper Cover
Cowl Side Trim
Front Door Scuff Plate
Column Lower Cover
Cowl Side Trim
C
C
C
Combination Switch
Lower Finish Panel
C
Fuse Box Opening Cover
34 (350, 25)
Steering Wheel Pad
Steenng Wheel
Front Door Scuff Plate
N·m (kgf·cm, ft·lbf): Specified torque
86820g09

Fig. 49 Exploded view of the instrument panel and related components — 1996 4Runner

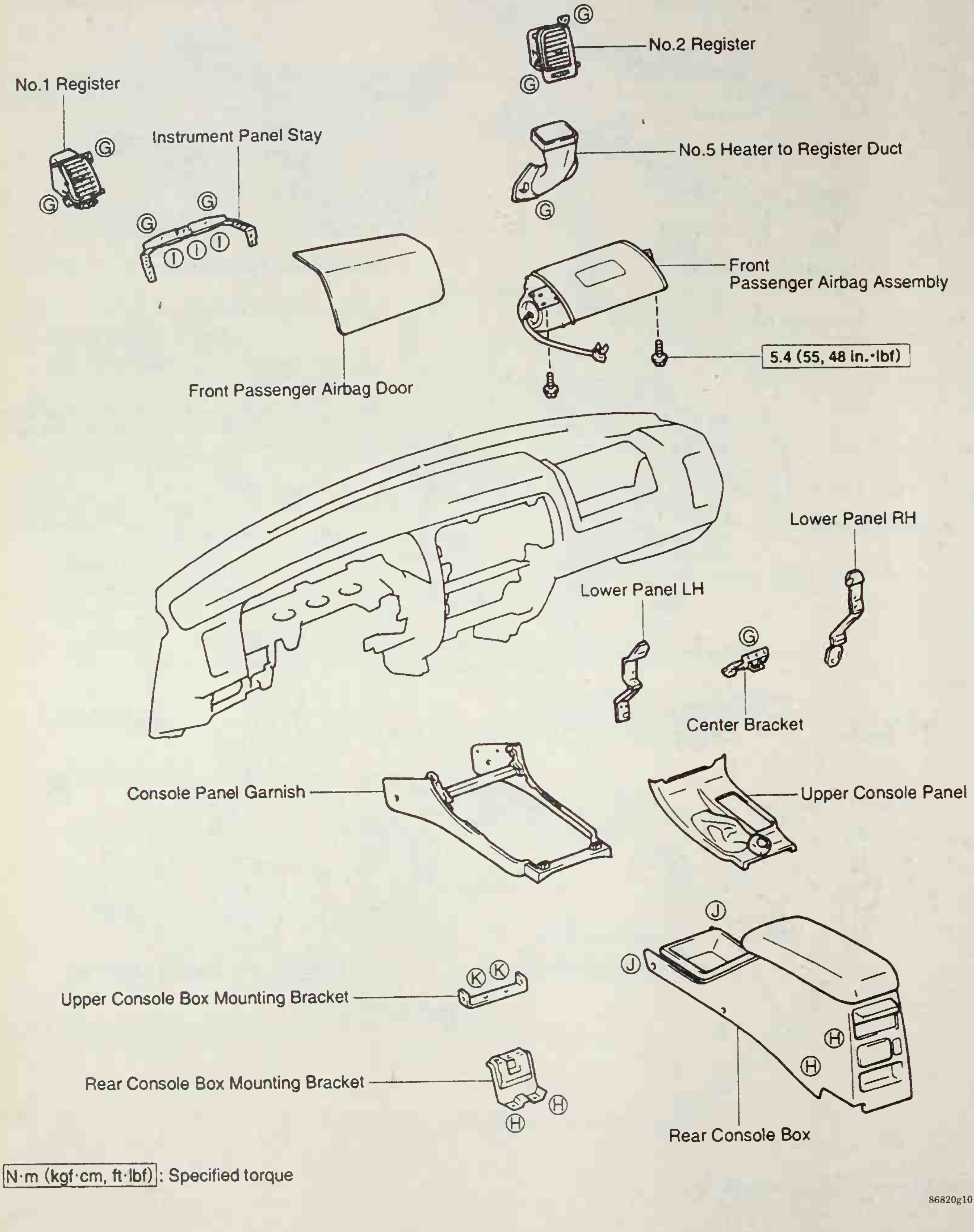

No.2 Register
No.1 Register
Instrument Panel Stay
No.5 Heater to Register Duct
Front Passenger Airbag Assembly
5.4 (55, 48 in.·lbf)
Front Passenger Airbag Door
Lower Panel RH
Lower Panel LH
Center Bracket
Console Panel Garnish
Upper Console Panel
Upper Console Box Mounting Bracket
Rear Console Box Mounting Bracket
Rear Console Box
G
H
I
J
K
N·m (kgf·cm, ft·lbf) : Specified torque
86820g10

Fig. 50 Exploded view of the instrument panel and related components — 1996 4Runner (continued)

T100

➧ **See Figures 51 and 52**

1. Disconnect the negative battery cable.
2. Remove the front pillar garnish.
3. Unscrew the front door scuff plate and the cowl side trims.
4. Remove the steering wheel.

⁂CAUTION

The air bag system (SRS) must be disarmed before removing the steering wheel or instrument panel. Refer to Section 6. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

5. Remove the following:
    - Steering column cover
    - Hood lock release lever
    - Lower finish panel No. 1
    - Combination switch
    - Glove box door
    - Lower finish panel No. 2.
    - Lower center panel
6. Remove the screws retaining the center cluster finish panel, then detach the harness from the unit.
7. Remove the stereo opening cover.
8. Unscrew the combination meter from the dash.
9. Remove the following:
    - No. 1 register
    - Duct heater-to-register No. 1
    - Duct heater-to-register No. 2
    - Glove compartment door reinforcement
    - Brace for the No. 1 and No. 2 registers
10. Detach the harness connections for the instrument panel, then remove the 2 bolts from the panel.
11. Unbolt the No. 3 brace, then remove the reinforcement.

To install:

12. Attach the reinforcement, then the No. 3 brace.
13. Attach the harness connections for the instrument panel, then tighten the 2 bolts for the panel.
14. Install the following:
    - No. 1 register
    - Duct heater-to-register No. 1
    - Duct heater-to-register No. 2
    - Glove compartment door reinforcement
    - Brace for the No. 1 and No. 2 registers
15. Tighten the combination meter into place.
16. Attach the stereo opening cover.
17. Attach the cluster harness, then install and tighten the screws that retain the center cluster finish panel.

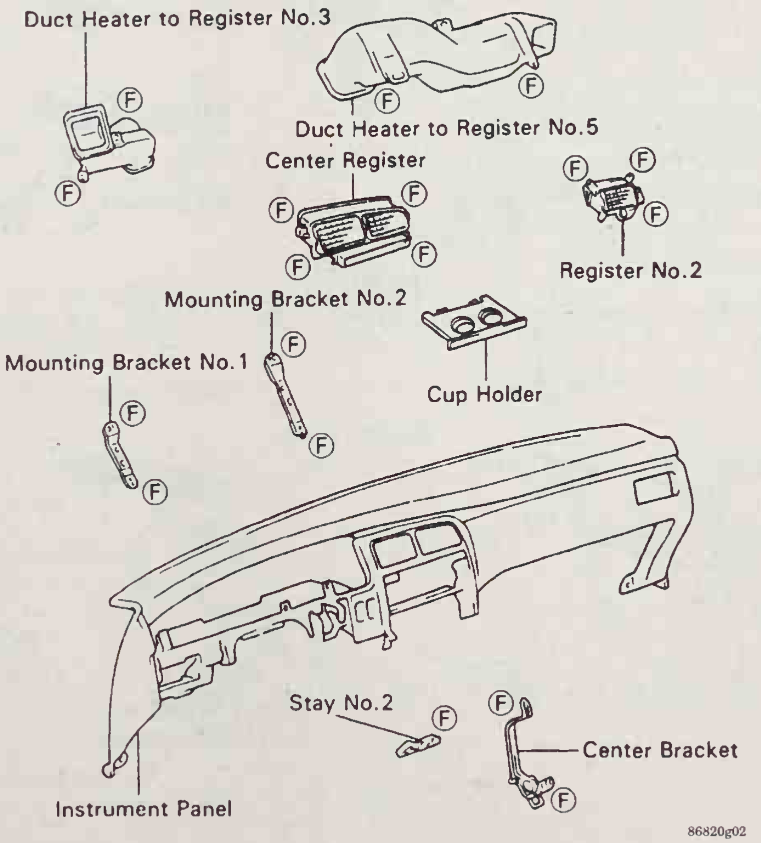

Duct Heater to Register No.3
Duct Heater to Register No.5
Center Register
Register No.2
Mounting Bracket No.2
Mounting Bracket No.1
Cup Holder
Stay No.2
Center Bracket
Instrument Panel
86820g02

Fig. 51 Exploded view of the instrument panel and related components — T100

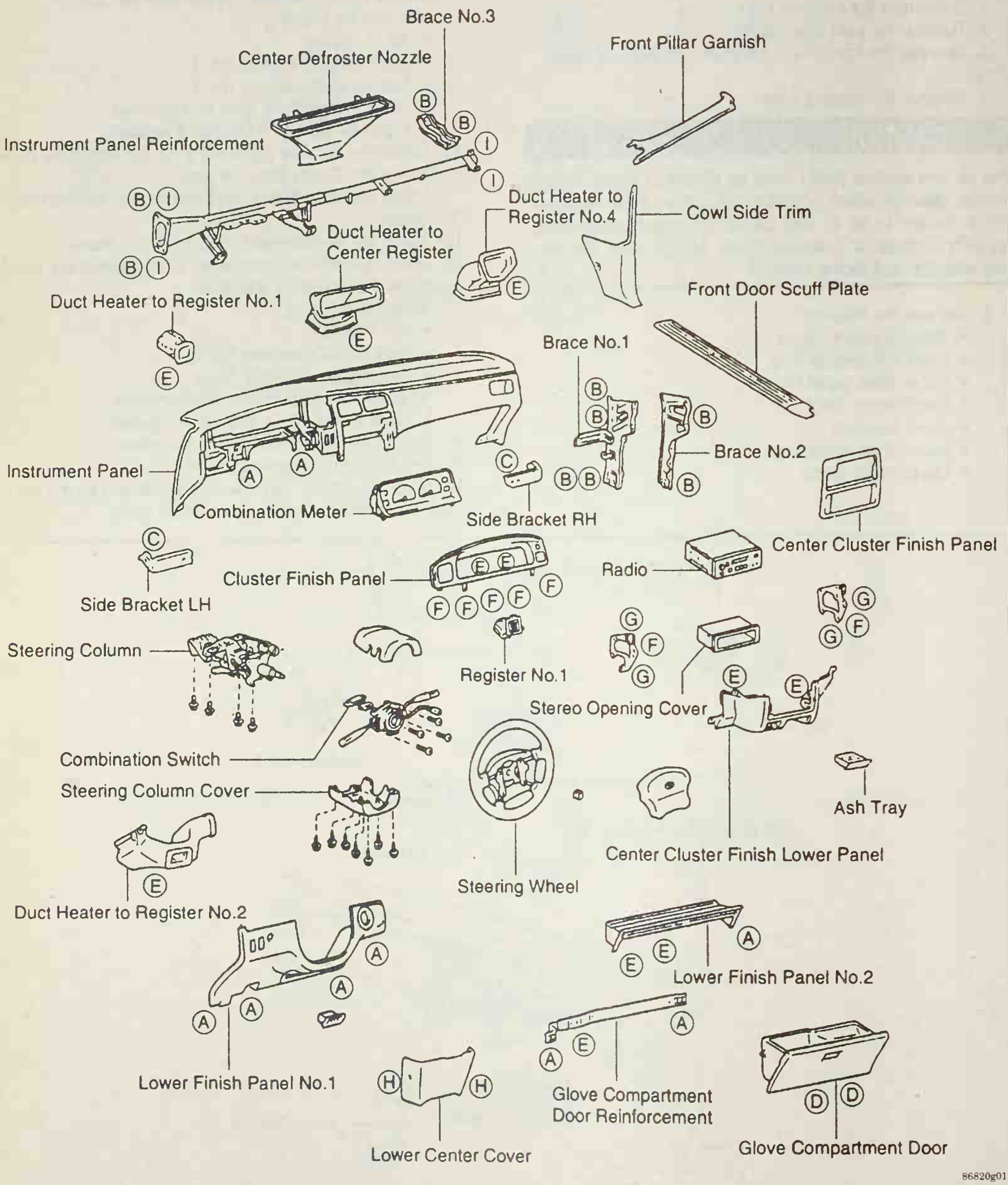

Brace No.3
Center Defroster Nozzle
Front Pillar Garnish
Ⓑ Ⓑ Ⓘ
Instrument Panel Reinforcement
Ⓑ Ⓘ Ⓘ
Duct Heater to Register No.4
Cowl Side Trim
Duct Heater to Center Register
Ⓑ Ⓘ
Ⓔ
Front Door Scuff Plate
Duct Heater to Register No.1
Ⓔ
Brace No.1
Ⓔ
Ⓑ Ⓑ Ⓑ
Brace No.2
Ⓑ
Instrument Panel
Ⓐ Ⓐ
Ⓒ
Ⓑ Ⓑ
Combination Meter
Side Bracket RH
Center Cluster Finish Panel
Ⓒ
Radio
Cluster Finish Panel
Ⓔ Ⓔ
Ⓕ Ⓕ Ⓕ Ⓕ Ⓕ
Side Bracket LH
Ⓖ Ⓕ Ⓖ
Steering Column
Ⓖ Ⓕ Ⓖ
Register No.1
Ⓔ Ⓔ
Stereo Opening Cover
Combination Switch
Steering Column Cover
Ash Tray
Center Cluster Finish Lower Panel
Ⓔ
Steering Wheel
Duct Heater to Register No.2
Ⓐ Ⓐ Ⓐ Ⓐ
Ⓔ Ⓔ Ⓐ
Lower Finish Panel No.2
Ⓐ Ⓔ Ⓐ
Lower Finish Panel No.1
Ⓗ Ⓗ
Glove Compartment Door Reinforcement
Ⓓ Ⓓ
Lower Center Cover
Glove Compartment Door
86820g01

Fig. 52 Exploded view of the instrument panel and related components — T100 (continued)

18. Install the following:
    - Steering column cover
    - Hood lock release lever
    - Lower finish panel No. 1
    - Combination switch
    - Glove box door
    - Lower finish panel No. 2.
    - Lower center panel
19. Install the steering wheel.
20. Attach, then tighten the front door scuff plate and the cowl side trims.
21. Place the front pillar garnish into position and tighten.
22. Connect the negative battery cable.

Tacoma

➧ See Figures 53, 54 and 55

1. Disconnect the negative battery cable.
2. Remove the steering wheel.

⁂CAUTION

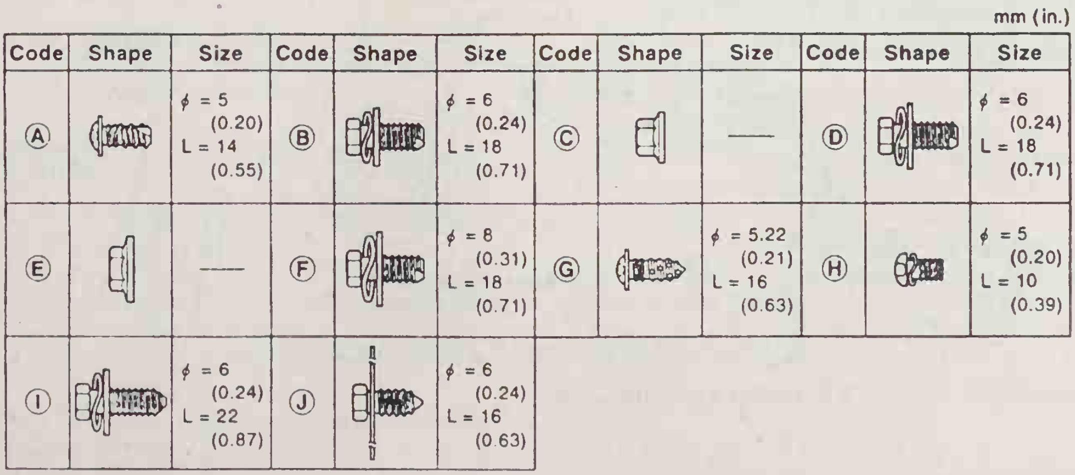
The air bag system (SRS) must be disarmed before removing the steering wheel or instrument panel. Refer to Section 6. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Remove the following:
    - Steering column cover
    - Hood lock release lever
    - Combination switch
    - Fuse box cover
4. Remove the lower left hand finish panel.
5. Remove the following parts:
    - Starter switch bezel
    - No. 2 heater-to-register
    - Steering column
    - Clock
6. Remove the cup holder and the heater control knobs.
7. With the aide of a flat bladed tool, remove the heater control panel.
8. Disconnect the hazard harness.
9. Remove the mounting screws for the center cluster finish panel.
10. Remove the heater control assembly.
11. Remove the radio.
12. Remove the screws mounting the cluster finish panel, then lower the panel.
13. Remove the combination meter screws, the speedometer cable. Disconnect the harness.
14. Remove the No. 1 register and the No. 1 heater-to-register duct.
15. Unscrew the glove compartment door and the reinforcement, then remove.
16. Unbolt the lower center instrument cover and remove the cover.
17. Separate the lower No. 2 finish panel from the dash.
18. Lift out the ashtray box and receptacle retainer.
19. Remove the stereo opening cover and the cigarette lighter harness.
20. Unbolt the side bracket for the instrument panel, then remove the instrument panel.
21. Unbolt the No. 1 and No. 2 brace for the instrument reinforcement. Remove the center heater-to-register duct.
22. Pull out the defroster nozzle.
23. Separate the reinforcement from the dahs.
24. To install, reverse the removal procedure.
25. Connect the negative battery cable.

Land Cruiser

1989-90 MODELS

1. Disconnect the negative battery cable.
2. Remove the steering wheel.
3. Remove the Nos. 2 and 3 air ducts. These are above the driver's knees under the dash.
4. Disconnect the throttle cable from the accelerator pedal and retainer. Remove the cable set nut and remove the cable.
5. Remove the hood release lever and the fuel lid opener lever.
6. Remove the heater control lever knobs. Remove the ash tray.



mm (in.)

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
Ⓐ		ϕ = 5 (0.20) L = 14 (0.55)	Ⓑ		ϕ = 6 (0.24) L = 18 (0.71)	Ⓒ		—	Ⓓ		ϕ = 6 (0.24) L = 18 (0.71)
Ⓔ		—	Ⓕ		ϕ = 8 (0.31) L = 18 (0.71)	Ⓖ		ϕ = 5.22 (0.21) L = 16 (0.63)	Ⓗ		ϕ = 5 (0.20) L = 10 (0.39)
Ⓘ		ϕ = 6 (0.24) L = 22 (0.87)	Ⓙ		ϕ = 6 (0.24) L = 16 (0.63)						

86820g16

Fig. 53 Various types of instrument panel bolts — Tacoma

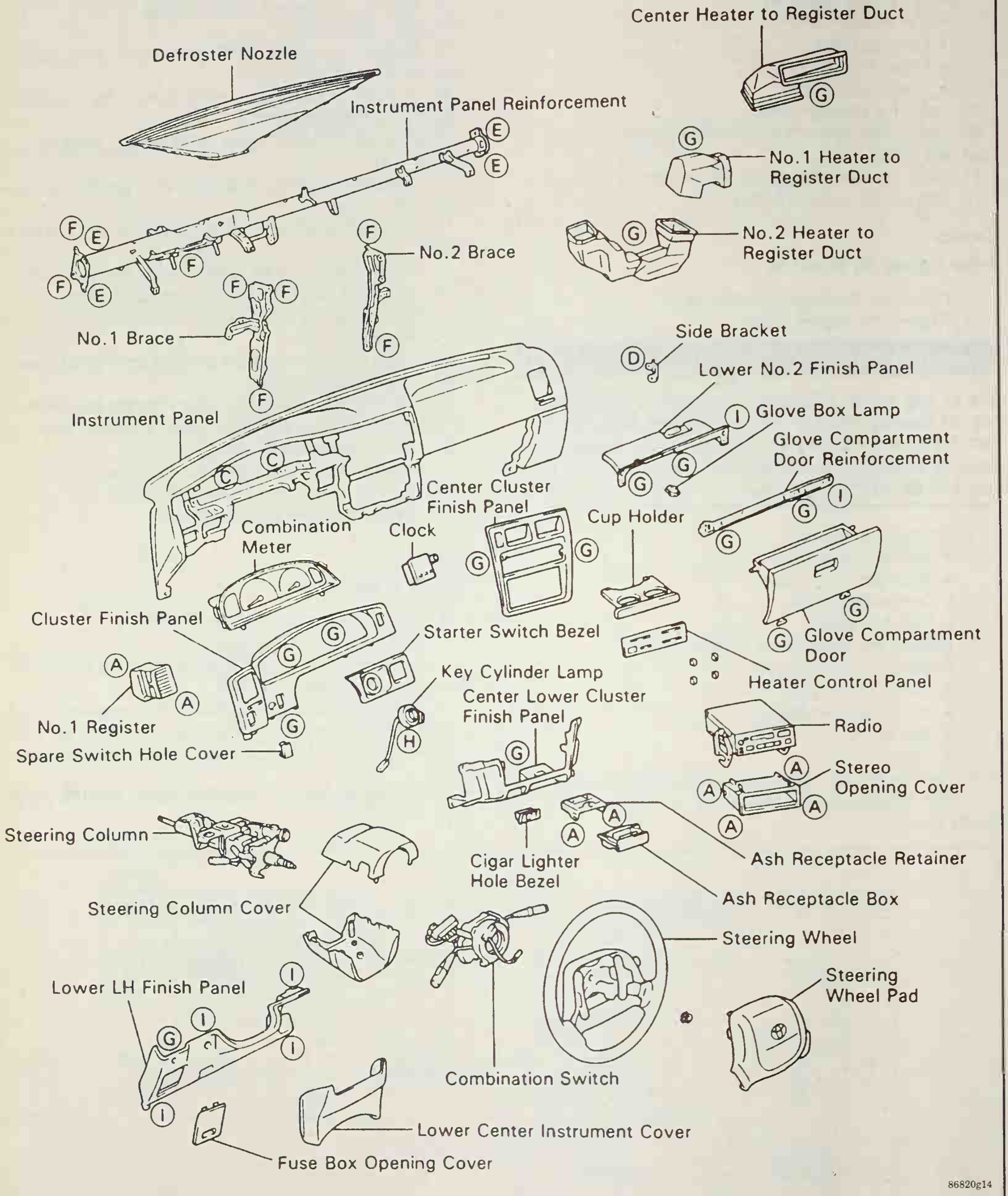

Center Heater to Register Duct
Defroster Nozzle
Instrument Panel Reinforcement
No.1 Heater to Register Duct
No.2 Brace
No.2 Heater to Register Duct
No.1 Brace
Side Bracket
Lower No.2 Finish Panel
Instrument Panel
Glove Box Lamp
Glove Compartment Door Reinforcement
Center Cluster Finish Panel
Combination Meter
Clock
Cup Holder
Cluster Finish Panel
Starter Switch Bezel
Glove Compartment Door
Key Cylinder Lamp
Heater Control Panel
Center Lower Cluster Finish Panel
No.1 Register
Radio
Spare Switch Hole Cover
Stereo Opening Cover
Steering Column
Cigar Lighter Hole Bezel
Ash Receptacle Retainer
Ash Receptacle Box
Steering Column Cover
Steering Wheel
Steering Wheel Pad
Lower LH Finish Panel
Combination Switch
Lower Center Instrument Cover
Fuse Box Opening Cover
86820g14

Fig. 54 Exploded view of the instrument panel and related components — Tacoma

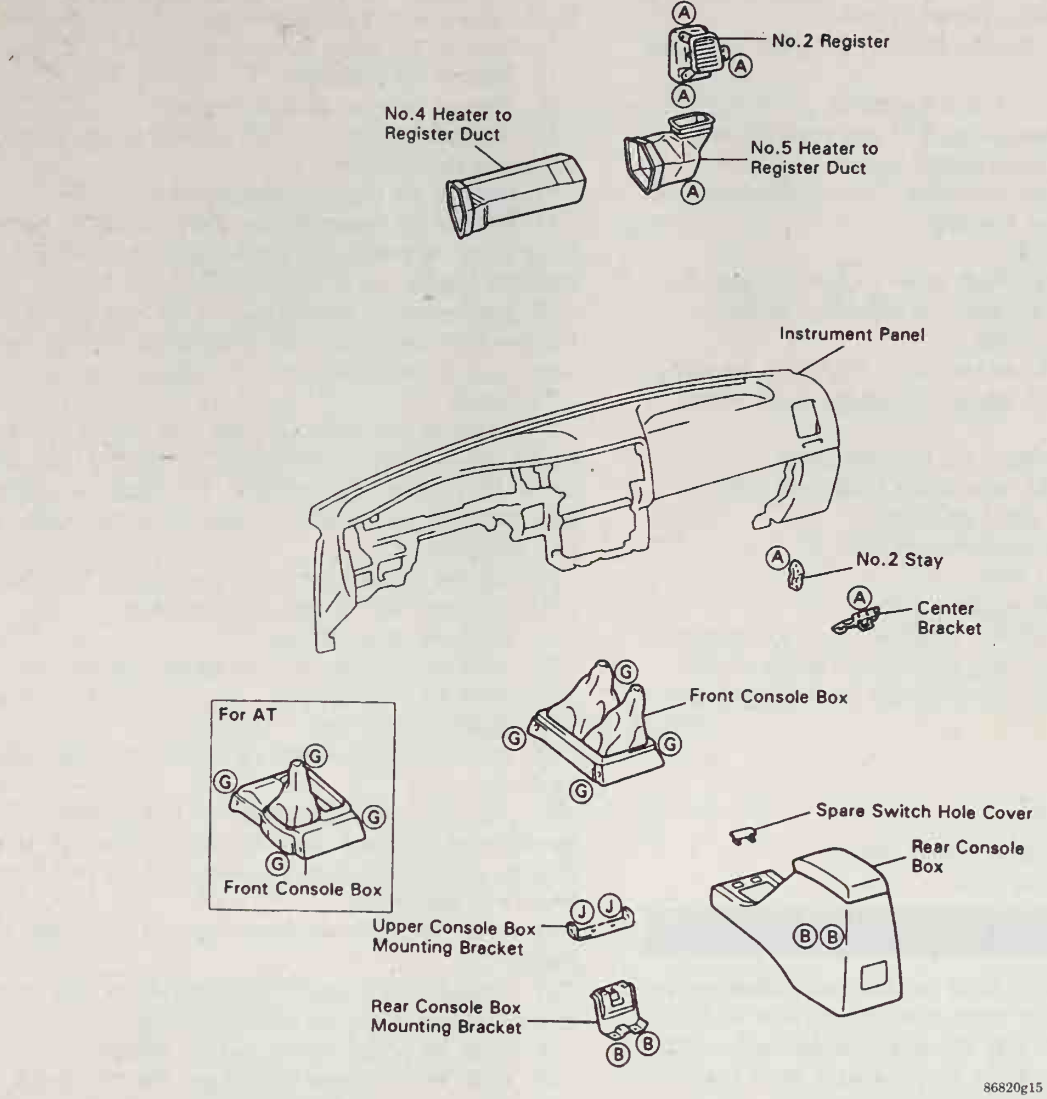

No.2 Register
No.4 Heater to Register Duct
No.5 Heater to Register Duct
Instrument Panel
No.2 Stay
Center Bracket
Front Console Box
For AT
Front Console Box
Spare Switch Hole Cover
Rear Console Box
Upper Console Box Mounting Bracket
Rear Console Box Mounting Bracket
A
G
B
J
86820g15

Fig. 55 Exploded view of the instrument panel and related components — Tacoma (continued)

7. Remove the five screws and two clips holding the center instrument finish panel. Remove the panel and disconnect the wiring harnesses.
8. Remove the seven screws holding the instrument cluster trim panel. Loosen the panel, disconnect the wiring and unhook the speedometer cable.
9. Remove the audio unit.
10. Remove the glove box door. Remove the courtesy switch and light.
11. Remove the four screws holding the glove box; remove the latch striker and remove the glove box.
12. Remove the mounting bolt holding the ECU; pull it out gently and disconnect the wire harness. Place the computer in a very safe location out of the work area.
13. Remove air ducts Nos. 1, 3 and 4; each is held by a single screw.
14. At the side defrosters, remove only the lower screw and disconnect the defroster hose.
15. Remove the four screws and four nuts holding the safety pad. Loosen two clips and remove the pad.
16. Remove the heater control panel.
17. Unplug the electrical connectors at the mirror control switch, the dimmer and 4WD control.
18. Remove the fuse box; it's attached by two screws.
19. Remove the two upper side mounting bolts holding the steering column.
20. The instrument panel is held by 15 bolts. Once the bolts are removed, move the panel towards the rear of the vehicle to remove it. Once removed, the various components still on the panel may be removed if desired.

To install:

21. Assemble the instrument panel with any items removed. Fit the panel into place, connect the wiring and secure the retaining bolts. Make certain the panel is flush and level. The heater vent ducts must match up exactly with no leaks. Make any needed adjustments now.
22. Install the upper side mounting bolts holding the steering column.
23. Install the fuse box and cover.
24. Connect the mirror control switch, the dimmer and the 4WD switch connectors.
25. Connect the cables and install the heater controls.

26. Install the safety pad, making sure the clips are properly seated and that the piece is properly aligned.
27. Connect the side defroster hoses to the grilles and install the lower screws.
28. Connect the Nos. 1, 3, and 4 air ducts.
29. Connect the harness to the ECU and install the unit. Make sure the harness is connected squarely and firmly.
30. Install the glove box and striker. Connect the switch and light, and install the glove box door.
31. Install the audio unit.
32. Place the instrument finish panel in place. Connect the speedometer cable and the electrical harnesses. Install the panel and the retaining screws.
33. Install the center lower trim panel, connecting the wiring as needed. Install the ash tray and install the heater control knobs.
34. Install the hood release and fuel door levers.
35. Connect the throttle cable to the accelerator pedal.
36. Install the Nos. 2 and 3 air ducts.
37. Install the steering column covers.
38. Install the steering wheel.
39. Connect the negative battery cable.
40. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

1991-95 MODELS

See Figures 56 and 57

1. Disconnect the negative battery cable.
2. Remove the steering wheel.

****CAUTION**

The air bag system (SRS) must be disarmed before removing the steering wheel or instrument panel. Refer to Section 6. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

3. Apply strips of protective tape on the inside of each windshield pillar. This will protect the trim during removal.
4. Remove the upper and lower steering column covers.
5. Remove the hood release and fuel door release levers.
6. Remove the four screws holding the lower trim panel below the steering column.
7. Remove the heater duct running to the left dash outlet (No. 2). The duct is the one under the dash, above the driver's knees.
8. Remove the combination switch from the steering column. Refer to section 6.
9. Remove the turn signal bracket from the steering column; it's the piece just below the combination switch.
10. Remove the ashtray and remove the ashtray holder.
11. Remove the three screws holding the lower instrument panel trim. The trim panel is held by six clips which must be released to remove the panel.
12. Remove the instrument cluster trim; it is held by six screws and two clips.
13. Remove the four screws holding the combination meter and gently loosen it; disconnect the electrical harnesses and unhook the speedometer cable. Place the instrument cluster in a safe location out of the work area.
14. Remove the heater control unit.
15. Remove the audio unit.
16. Remove the front (shifter) console.
17. Remove the dash mounted speaker covers. Remove and disconnect the speakers.
18. Remove the glove compartment door.
19. Remove the screws holding the engine ECU; gently remove it and disconnect the wire harness. Place the ECU in a protected location out of the work area.
20. The instrument panel is held by 10 bolts and six screws. Remove them and remove the panel. Once removed, the safety pad, air vents, etc. may be removed if desired.

To install:

21. Assemble the instrument panel with any items removed. Fit the panel into place and secure the retaining bolts. Make certain the panel is flush and level. The heater vent ducts must match up exactly with no leaks. Make any needed adjustments now.
22. Connect the wire harness to the engine ECU. Install the ECU in the right side of the instrument panel.
23. Install the glove box door.
24. Install the speakers and the speaker covers.
25. Install the front console.
26. Install the audio unit.
27. Install the heater control unit. Don't forget the knobs on the levers.
28. Place the combination meter in position. Connect the speedometer cable and attach the wiring connectors. Make sure the electrical connectors are squarely and firmly seated. Install the meter unit.
29. Install the cluster trim panel. Make sure the clips are in place.
30. Install the lower center trim panel. All six clips must be correctly seated. Install the retaining screws.
31. Install the ashtray holder and the ashtray.
32. Install the turn signal bracket and the combination switch.
33. Connect the heater duct to air outlet No. 2.
34. Install the lower trim panel and the 4 screws.
35. Attach the hood and fuel door levers.
36. Install the steering column covers. Install the steering wheel.
37. Remove the protective tape from the windshield pillars.
38. Connect the negative battery cable.
39. Start the engine, allowing it to idle. Check the function of each dash component including all switches, heater and A/C output, speaker operation and dashboard warning lamps and instruments.

1996 MODELS

See Figures 58, 59 and 60

****CAUTION**

The air bag system (SRS) must be disarmed before removing the steering wheel or instrument panel. Refer to Section 6. Failure to do so may cause accidental deployment, property damage or personal injury. Always store the air bag with the pad facing upward.

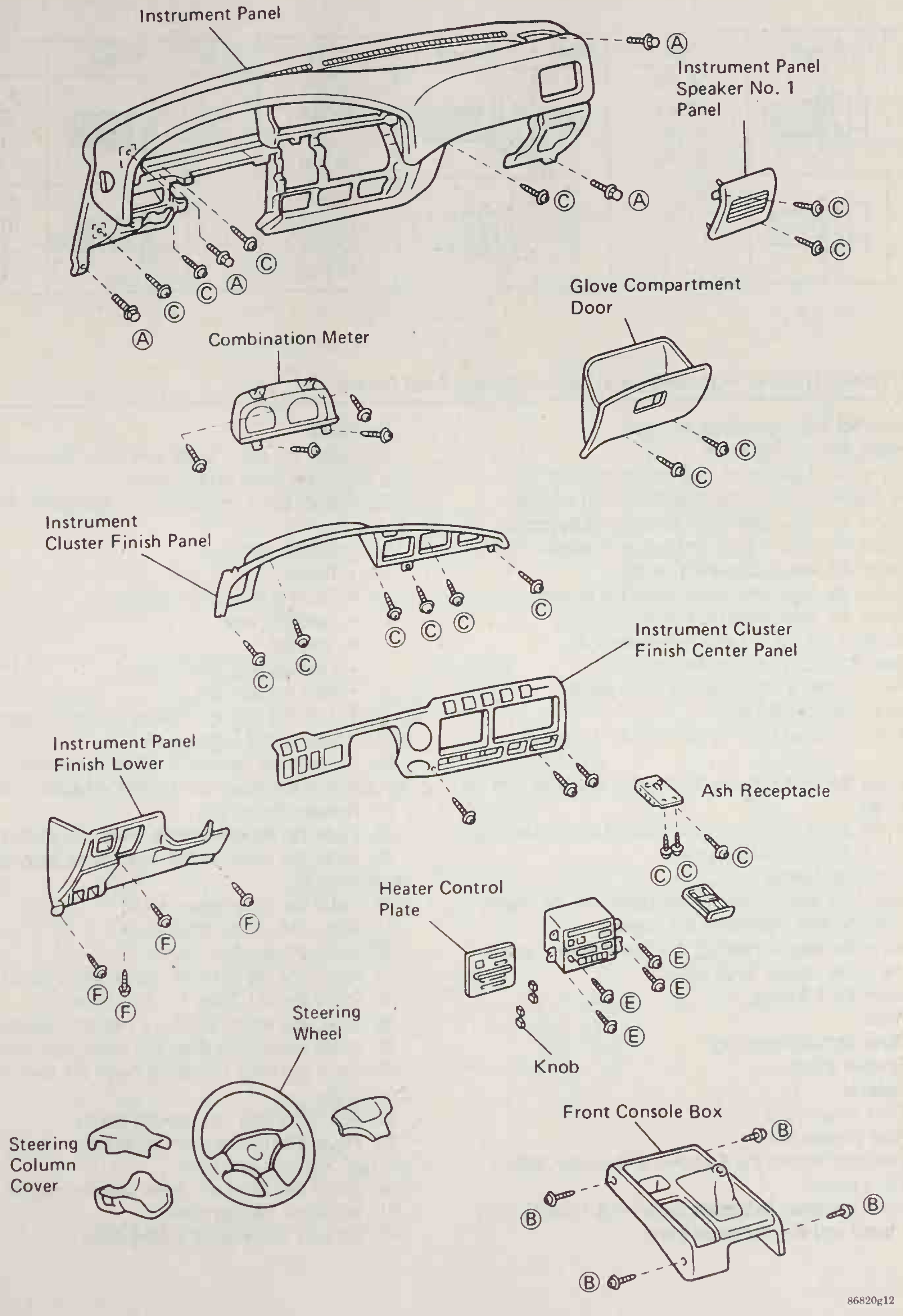
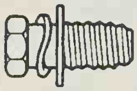
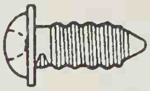
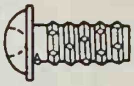
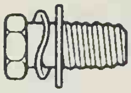
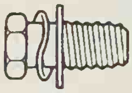
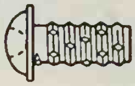

Instrument Panel
Ⓐ
Instrument Panel Speaker No. 1 Panel
Ⓒ
Glove Compartment Door
Combination Meter
Instrument Cluster Finish Panel
Instrument Cluster Finish Center Panel
Ash Receptacle
Instrument Panel Finish Lower
Ⓕ
Heater Control Plate
Ⓔ
Knob
Steering Wheel
Steering Column Cover
Front Console Box
Ⓑ
86820g12

Fig. 56 Exploded view of the instrument panel and related components — 1991-95 Land Cruiser

mm (in.)

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
Ⓐ		$\phi = 6$ (0.24) L = 25 (0.98)	Ⓑ		$\phi = 5$ (0.20) L = 25 (0.98)	Ⓒ		$\phi = 5.22$ (0.2055) L = 14 (0.55)
Ⓓ		$\phi = 8$ (0.31) L = 30 (1.18)	Ⓔ		$\phi = 5$ (0.20) L = 16 (0.62)	Ⓕ		$\phi = 5.22$ (0.2055) L = 18 (0.71)

86820g13

Fig. 57 Various types of instrument panel bolts — 1991-95 Land Cruiser

1. Disconnect the negative battery cable.
2. Remove the steering wheel.
3. Apply strips of protective tape on the inside of each windshield pillar. This will protect the trim during removal.
4. Remove the upper and lower steering column covers.
5. Remove the hood release and fuel door release levers.
6. Remove the fuse box opening cover.
7. Unscrew the lower trim panel below the steering column.
8. Remove the lower instrument panel.
9. Disconnect the No. 2 heater-to-register duct.
10. Loosen the DLC3 and the fuse block.
11. Detach the No. 2 center cluster finish panel.
12. Remove the steering column.
13. Unbolt the cluster finish panel, then the combination meter.
14. Remove the center cluster finish panel assembly with the clock attached.
15. With the aid of a taped prytool, take off the 2 claws, then remove the cup holder hole cover.
16. Remove the ashtray.
17. Unscrew the center cluster finish panel with the heater control assembly, then disconnect the harness.
18. Remove the screws retaining the heater control assembly from the center cluster finish panel.
19. Remove the following:
    - Radio
    - Glove compartment door
    - Speaker panel
    - Speaker
    - Front console box
    - Rear console box
20. Loosen and remove the 5 screws and 9 bolts holding the instrument panel.
21. Remove the lower instrument panel reinforcement, then the No. 1 brace and the instrument panel.

To install:

22. Attach the No. 1 brace and lower instrument panel, then the instrument panel reinforcement.
23. Tighten the 5 screws and 9 bolts holding the instrument panel.
24. Install the following:
    - Radio
    - Glove compartment door
    - Speaker panel
    - Speaker
    - Front console box
    - Rear console box
25. Tighten the screws retaining the heater control assembly to the center cluster finish panel.
26. Connect the harness to the heater control, then attach the center cluster finish panel with the heater control assembly.
27. Reinstall the ashtray.
28. Place the cup holder hole cover into position.
29. Install the center cluster finish panel assembly with the clock attached.
30. Install the combination meter.
31. Attach the cluster finish panel.
32. Install the steering column.
33. Attach the No. 2 center cluster finish panel.
34. Install the DLC3 and the fuse block.
35. Insert and attach the No. 2 heater-to-register duct.
36. Install and tighten down the lower instrument panel.
37. Place the lower trim panel below the steering column, then tighten.
38. Attach the fuse box opening cover.
39. Place into position, then tighten down the hood release and fuel door release levers.
40. Attach the upper and lower steering column covers.
41. Install the steering wheel.
42. Connect the negative battery cable.

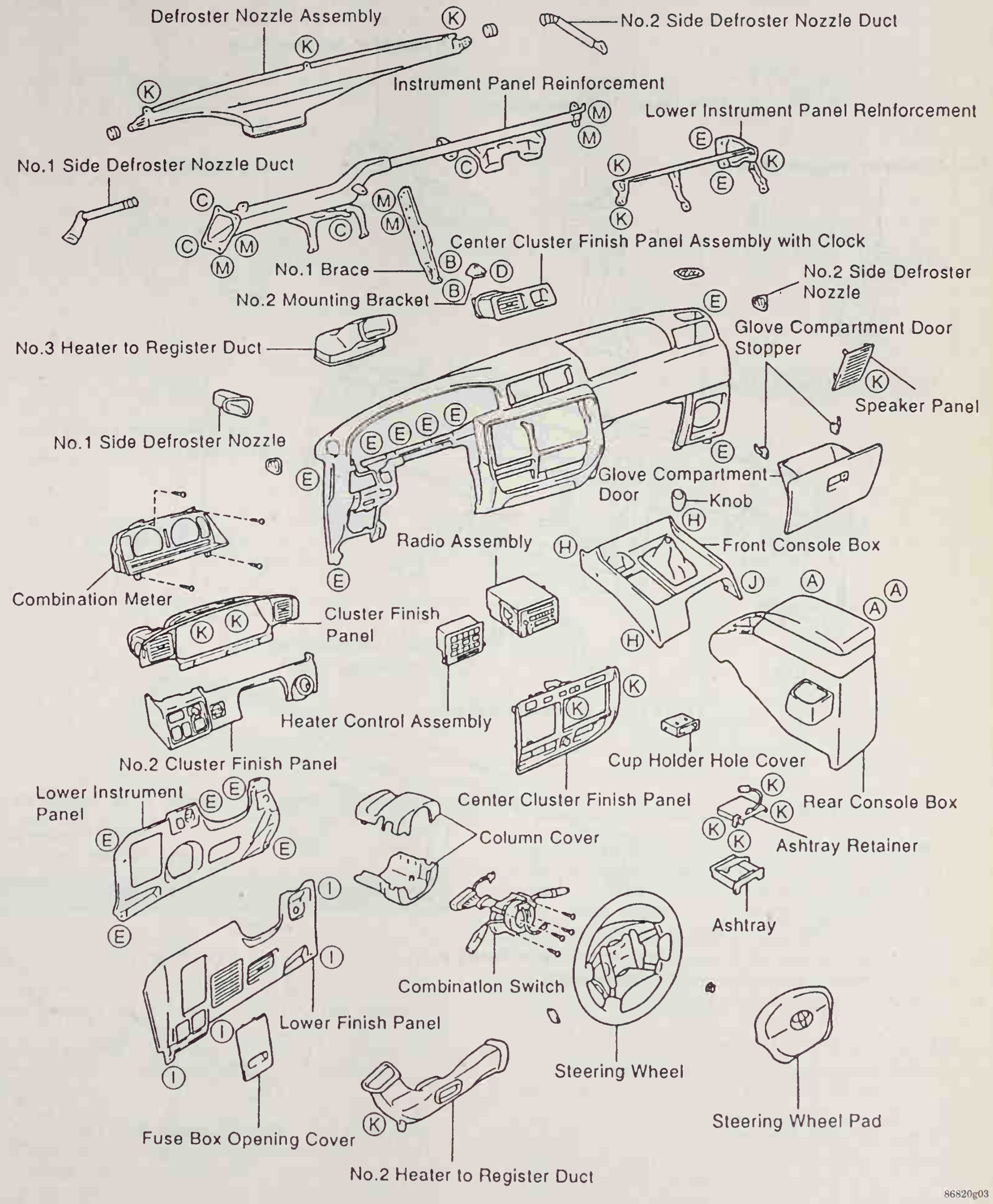

Defroster Nozzle Assembly
No.2 Side Defroster Nozzle Duct
Instrument Panel Reinforcement
Lower Instrument Panel Reinforcement
No.1 Side Defroster Nozzle Duct
Center Cluster Finish Panel Assembly with Clock
No.1 Brace
No.2 Side Defroster Nozzle
No.2 Mounting Bracket
Glove Compartment Door Stopper
No.3 Heater to Register Duct
Speaker Panel
No.1 Side Defroster Nozzle
Glove Compartment Door
Knob
Front Console Box
Radio Assembly
Combination Meter
Cluster Finish Panel
Heater Control Assembly
No.2 Cluster Finish Panel
Cup Holder Hole Cover
Rear Console Box
Lower Instrument Panel
Center Cluster Finish Panel
Column Cover
Ashtray Retainer
Ashtray
Combination Switch
Lower Finish Panel
Steering Wheel
Steering Wheel Pad
Fuse Box Opening Cover
No.2 Heater to Register Duct
86820g03

Fig. 58 Exploded view of the instrument panel and related components — 1996 Land Cruiser

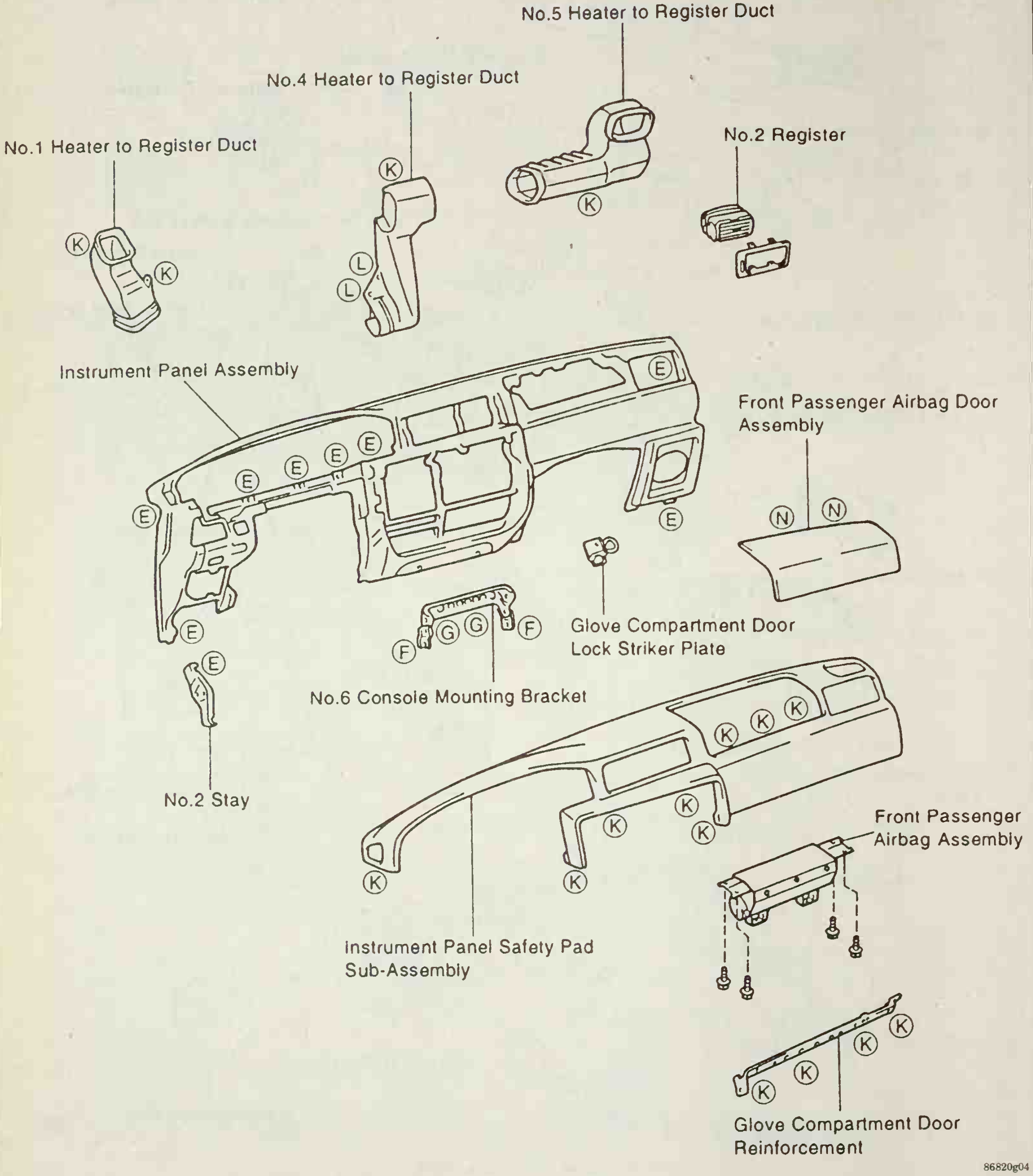
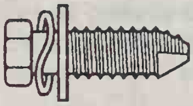
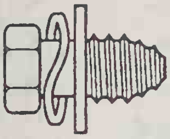
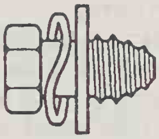
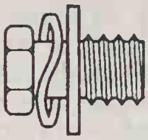
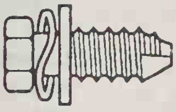
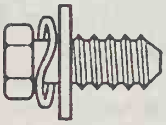
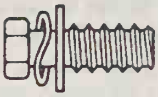
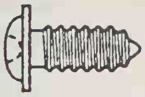
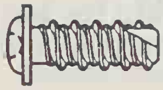
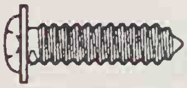
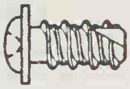
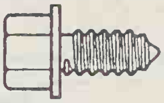
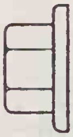
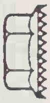

No.5 Heater to Register Duct
No.4 Heater to Register Duct
No.1 Heater to Register Duct
No.2 Register
K
K
K
K
L
L
Instrument Panel Assembly
E
E
E
E
E
E
E
E
E
Front Passenger Airbag Door Assembly
N
N
Glove Compartment Door Lock Striker Plate
F
G
G
F
No.6 Console Mounting Bracket
No.2 Stay
K
K
K
K
K
K
K
K
Front Passenger Airbag Assembly
Instrument Panel Safety Pad Sub-Assembly
K
K
K
K
Glove Compartment Door Reinforcement
86820g04

Fig. 59 Exploded view of the instrument panel and related components — 1996 Land Cruiser (continued)

mm (in.)

Code	Shape	Size	Code	Shape	Size	Code	Shape	Size
Ⓐ		ϕ = 8 (0.31) L = 30 (1.18)	Ⓑ		ϕ = 8 (0.31) L = 18 (0.71)	Ⓒ		ϕ = 8 (0.31) L = 16 (0.63)
Ⓓ		ϕ = 8 (0.31) L = 16 (0.63)	Ⓔ		ϕ = 6 (0.24) L = 20 (0.79)	Ⓕ		ϕ = 6 (0.24) L = 18 (0.71)
Ⓖ		ϕ = 5 (0.20) L = 18 (0.71)	Ⓗ		ϕ = 5 (0.20) L = 16 (0.63)	Ⓘ		ϕ = 5 (0.20) L = 18 (0.71)
Ⓙ		ϕ = 5 (0.20) L = 25 (0.98)	Ⓚ		ϕ = 5 (0.20) L = 14 (0.55)	Ⓛ		ϕ = 5 (0.20) L = 14 (0.55)
Ⓜ		ϕ = 8 (0.31)	Ⓝ		ϕ = 6 (0.24)			

86820g05

Fig. 60 Various types of instrument panel bolts — 1996 Land Cruiser

Door Panels

REMOVAL & INSTALLATION

➧ **See Figures 61, 62, 63, 64, 65, 66, 67, 68, 69, 70 and 71**

➡This is a general procedure. Depending on vehicle and model, the order of steps may need to be changed slightly.

1. Remove the inner mirror control knob (if manual remote) and remove the inner triangular cover from the mirror mount.
2. Remove the screws holding the armrest and remove the armrest. The armrest screws may be concealed behind plastic caps which may be popped out with a non-marring tool.
3. Remove the surround or cover for the inside door handle. Again, seek the hidden screw; remove it and slide the cover off over the handle.
4. If not equipped with electric windows, remove the window winder handle. This can be tricky, but not difficult. Install a piece of tape on the door pad to show the position of the handle before removal. The handle is held onto the winder axle by a spring clip shaped like the Greek letter Ω. The clip is located between the back of the winder handle and the door pad. It is correctly installed with the legs pointing along the length of the winder handle. There are three common ways of removing the clip:
   a. Use a door handle removal tool. This inexpensive slotted and toothed tool can be fitted between the winder and the panel and used to push the spring clip free.
   b. Use a rag or piece of cloth and work it back and forth between the winder and door panel. If constant upward tension is kept, the clip will be forced free. Keep watch on the clip as it pops out; it may get lost.
   c. Straighten a common paper clip and bend a very small J-hook at the end of it. Work the hook down from the top of the winder and engage the loop of the spring clip. As you pull the clip free, keep your other hand over the area. If this

is not done, the clip may vanish to an undisclosed location, never to be seen again.

5. In general, power door lock and window switches mounted on the door pad (not the armrest) may remain in place until the pad is removed. Some cannot be removed until the doorpad is off the door.

6. If the truck has manual vertical door locks, remove the lock knob by unscrewing it. If this is impossible (because they're in square housings), wait until the pad is lifted free.

7. Using a broad, flat-bladed tool, (not a screwdriver) begin to gently pry the door pad away from the door. You are releasing plastic inserts from plastic seats. There will be 6-12 of them around the door. With care, the plastic inserts can be reused several times.

8. When all the clips are loose, lift up on the panel to release the lip at the top of the door. This may require a bit of jiggling to loosen the panel; do so gently and don't damage the panel. The upper edge (at the window sill) is attached by a series of retaining clips.

9. Once the panel is free, keep it close to the door and check behind it. Disconnect any wiring for switches, lights or speakers which may be attached.

➡Behind the panel is a plastic or paper sheet taped or glued to the door. This is a watershield and must be intact to prevent water entry into the car. It must be securely attached at its edges and not be ripped or damaged. Small holes or tears can be patched with waterproof tape applied to both sides of the liner.

To install:

10. When reinstalling, connect any wiring harnesses and align the upper edge of the panel along the top of the door first. Make sure the left-right alignment is correct; tap the top of the panel into place with the heel of your hand.

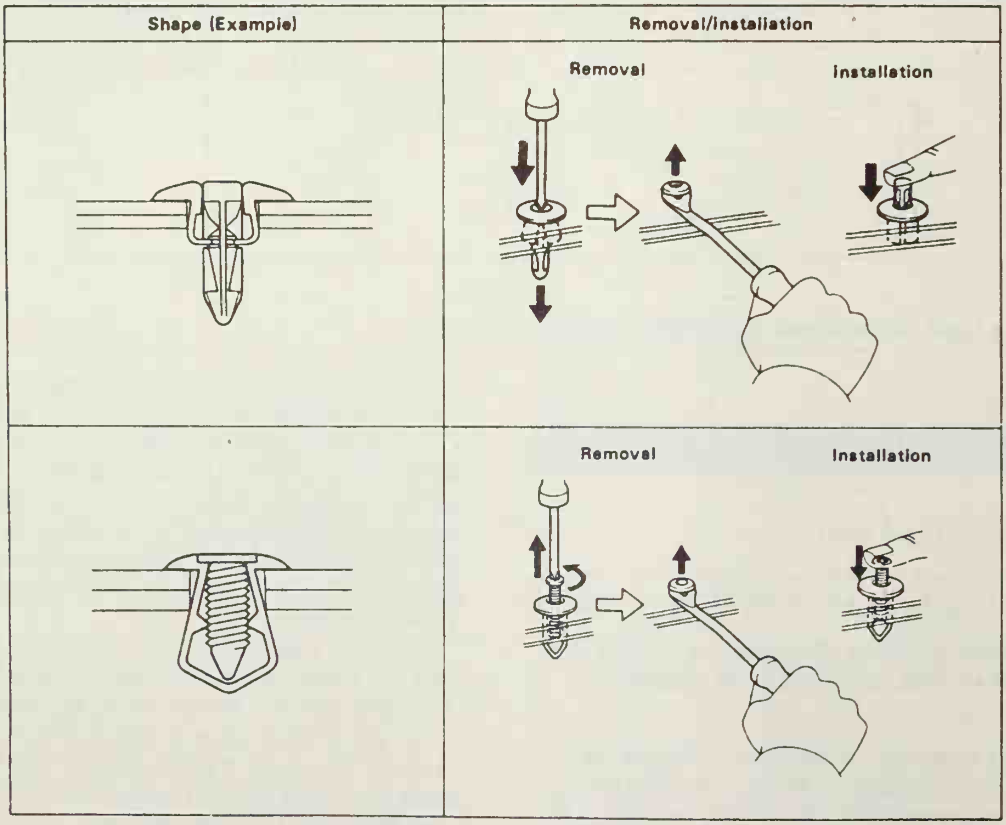
11. Make sure the plastic clips align with their holes; pop each retainer into place with gentle pressure.

12. Install the armrest and door handle bezel, remembering to install any caps or covers over the screws.

13. Install the window winder handle on vehicles with manual windows. Place the spring clip into the slot on the handle, remembering that the legs should point along the long dimension of the handle. Align the handle with the tape mark made earlier and put the winder over the end of the axle. Use the heel of your hand to give the center of the winder a short, sharp blow. This will cause the winder to move inward and the spring will engage its locking groove. The secret to this trick is to push the winder straight on; if it's crooked, it won't engage and you may end up looking for the spring clip.

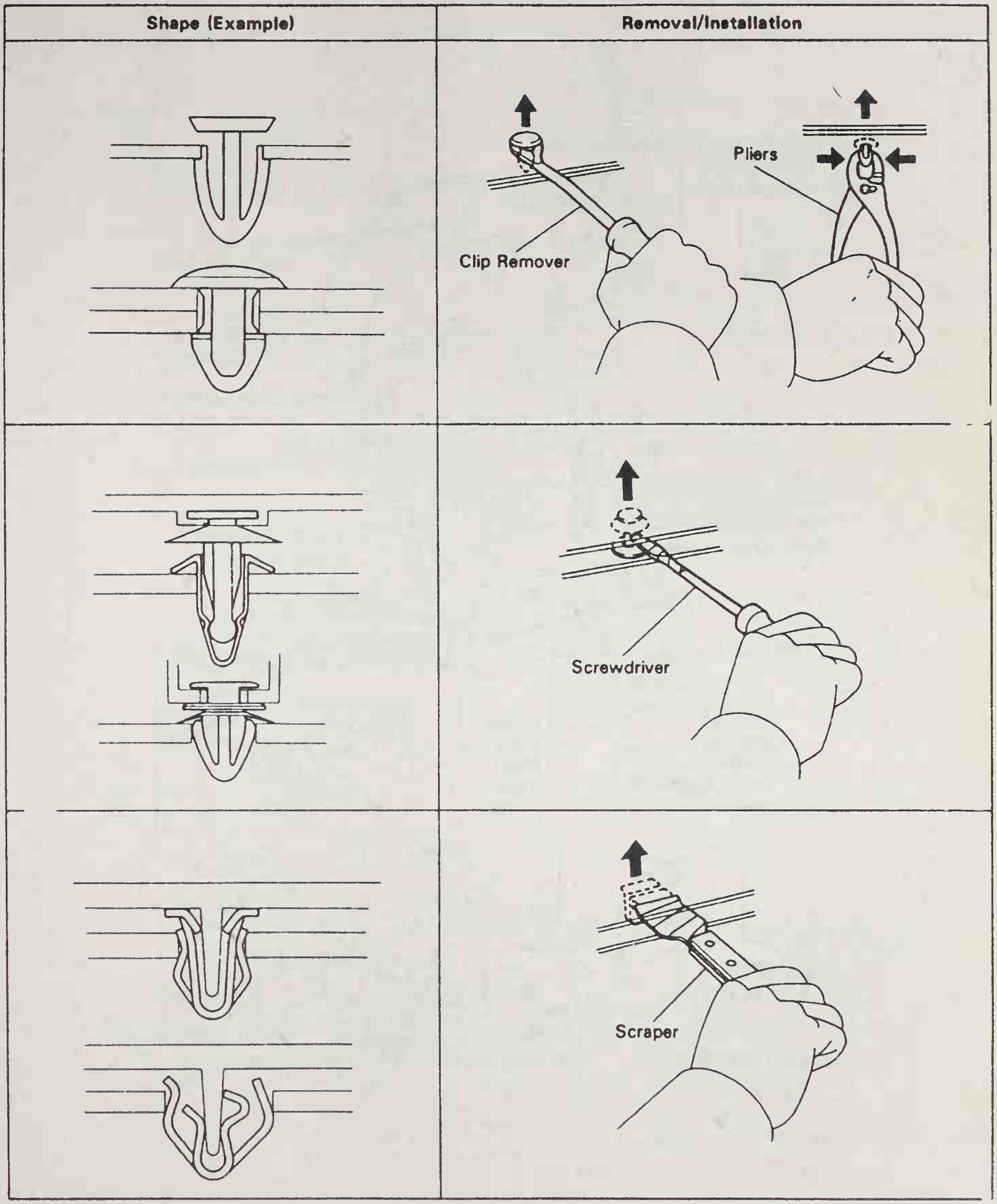
14. Install any remaining parts or trim pieces which may have been removed earlier. (Map pockets, speaker grilles, etc.)

15. Install the triangle cover and the remote mirror handle if they were removed.



86820g61

Fig. 61 Methods of removal and installation of the most common clips used in body parts


Shape (Example)
Removal/Installation
Clip Remover
Pliers
Screwdriver
Scraper

86820g60

Fig. 62 Methods of removal and installation of the most common clips used in body parts (continued)

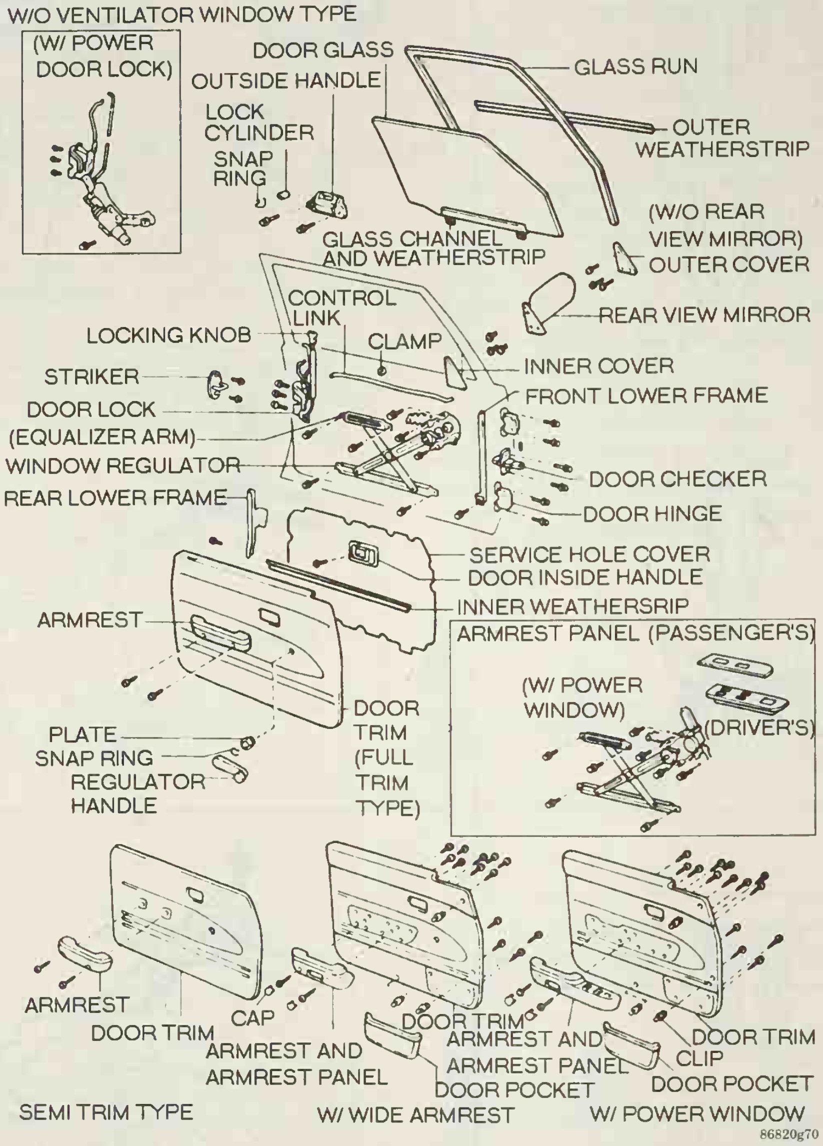

W/O VENTILATOR WINDOW TYPE
(W/ POWER DOOR LOCK)
DOOR GLASS
GLASS RUN
OUTSIDE HANDLE
LOCK CYLINDER
OUTER WEATHERSTRIP
SNAP RING
(W/O REAR VIEW MIRROR)
GLASS CHANNEL AND WEATHERSTRIP
OUTER COVER
CONTROL LINK
REAR VIEW MIRROR
LOCKING KNOB
CLAMP
INNER COVER
STRIKER
FRONT LOWER FRAME
DOOR LOCK
(EQUALIZER ARM)
WINDOW REGULATOR
DOOR CHECKER
REAR LOWER FRAME
DOOR HINGE
SERVICE HOLE COVER
DOOR INSIDE HANDLE
INNER WEATHERSRIP
ARMREST
ARMREST PANEL (PASSENGER'S)
(W/ POWER WINDOW)
(DRIVER'S)
DOOR TRIM (FULL TRIM TYPE)
PLATE
SNAP RING
REGULATOR HANDLE
ARMREST
DOOR TRIM
CAP
ARMREST AND ARMREST PANEL
DOOR TRIM
ARMREST AND ARMREST PANEL
DOOR POCKET
DOOR TRIM
CLIP
DOOR POCKET
SEMI TRIM TYPE
W/ WIDE ARMREST
W/ POWER WINDOW
86820g70

Fig. 63 Exploded view of the front door without a vent window — 1989-95 Pick-Up

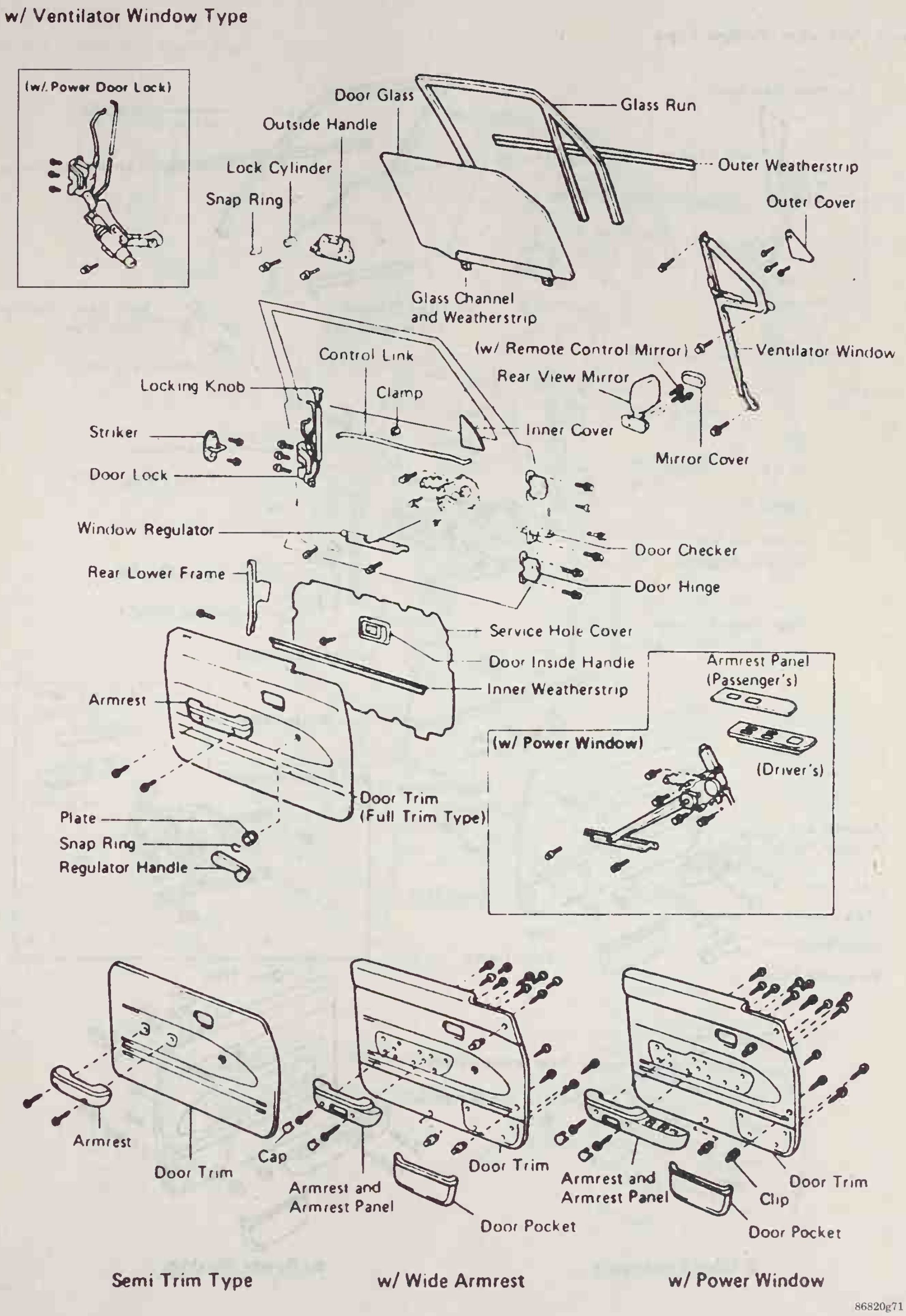

w/ Ventilator Window Type
(w/ Power Door Lock)
Door Glass
Outside Handle
Lock Cylinder
Snap Ring
Glass Run
Outer Weatherstrip
Outer Cover
Glass Channel
and Weatherstrip
Control Link
Clamp
(w/ Remote Control Mirror)
Ventilator Window
Locking Knob
Rear View Mirror
Striker
Inner Cover
Mirror Cover
Door Lock
Window Regulator
Door Checker
Rear Lower Frame
Door Hinge
Service Hole Cover
Door Inside Handle
Armrest Panel
(Passenger's)
Inner Weatherstrip
Armrest
(w/ Power Window)
(Driver's)
Door Trim
(Full Trim Type)
Plate
Snap Ring
Regulator Handle
Armrest
Door Trim
Cap
Armrest and
Armrest Panel
Door Trim
Door Pocket
Armrest and
Armrest Panel
Door Trim
Clip
Door Pocket
Semi Trim Type
w/ Wide Armrest
w/ Power Window
86820g71

Fig. 64 Exploded view of the front door with a vent window — 1989-95 Pick-Up

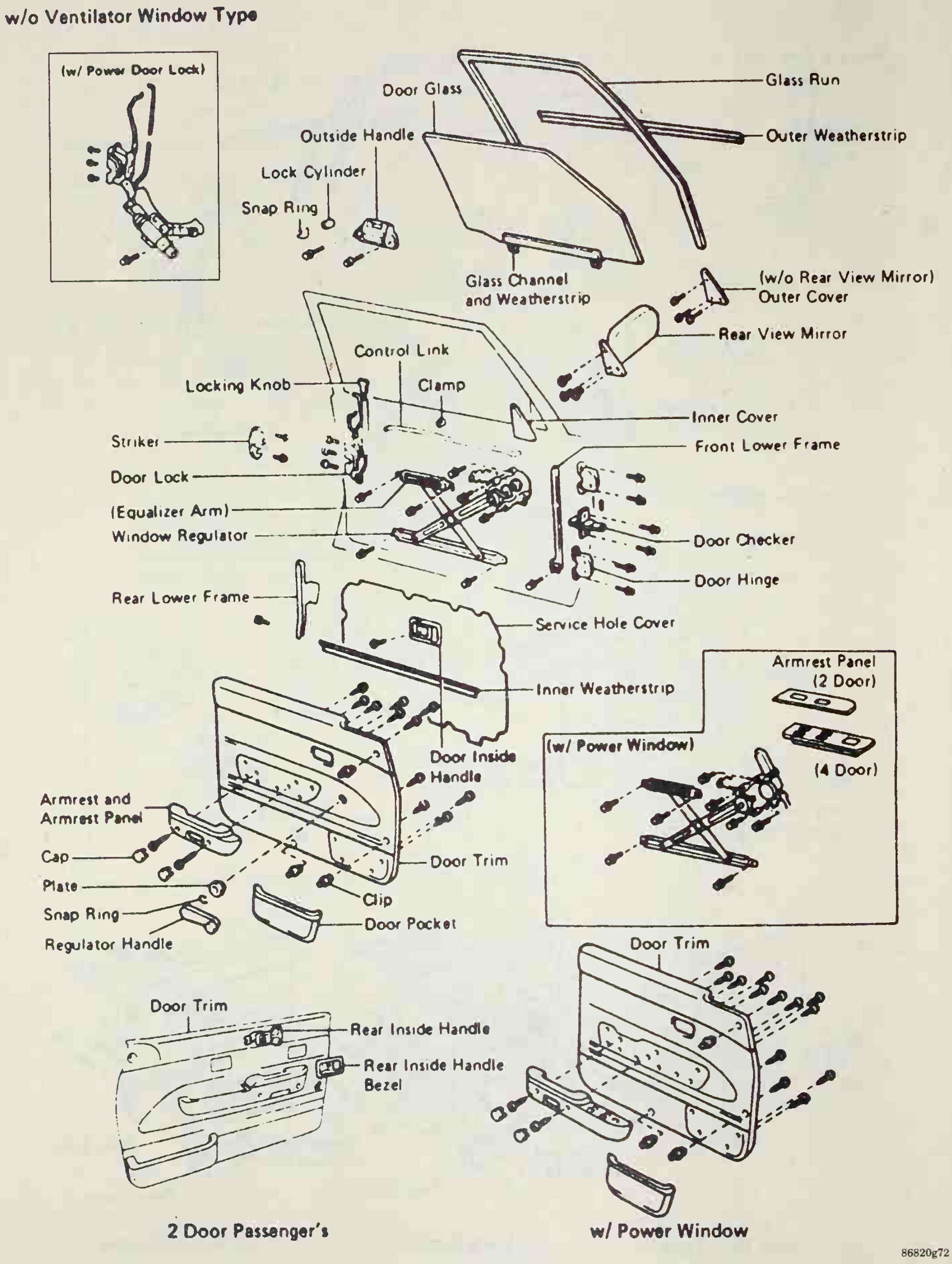

w/o Ventilator Window Type
(w/ Power Door Lock)
Door Glass
Glass Run
Outer Weatherstrip
Outside Handle
Lock Cylinder
Snap Ring
Glass Channel and Weatherstrip
(w/o Rear View Mirror) Outer Cover
Rear View Mirror
Control Link
Locking Knob
Clamp
Inner Cover
Striker
Front Lower Frame
Door Lock
(Equalizer Arm)
Window Regulator
Door Checker
Door Hinge
Rear Lower Frame
Service Hole Cover
Armrest Panel (2 Door)
Inner Weatherstrip
(w/ Power Window)
(4 Door)
Door Inside Handle
Armrest and Armrest Panel
Cap
Door Trim
Plate
Clip
Snap Ring
Door Pocket
Regulator Handle
Door Trim
Door Trim
Rear Inside Handle
Rear Inside Handle Bezel
2 Door Passenger's
w/ Power Window
86820g72

Fig. 65 Exploded view of the front door without a vent window — 1989-95 4Runner

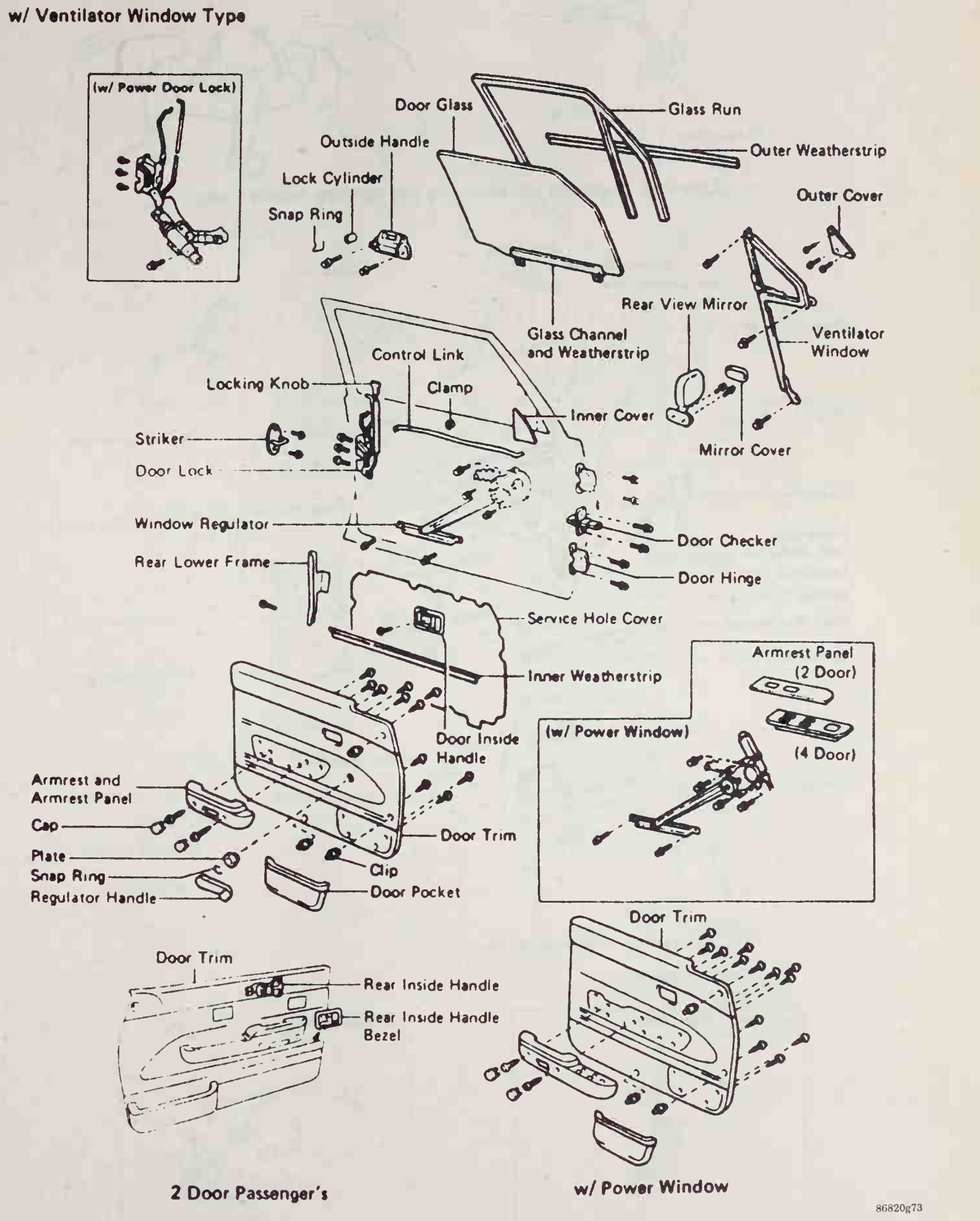
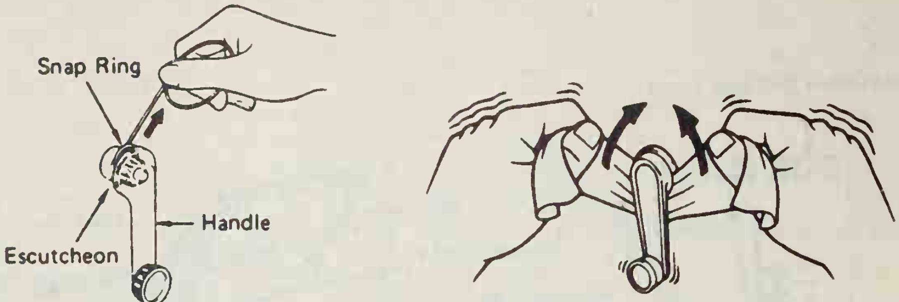
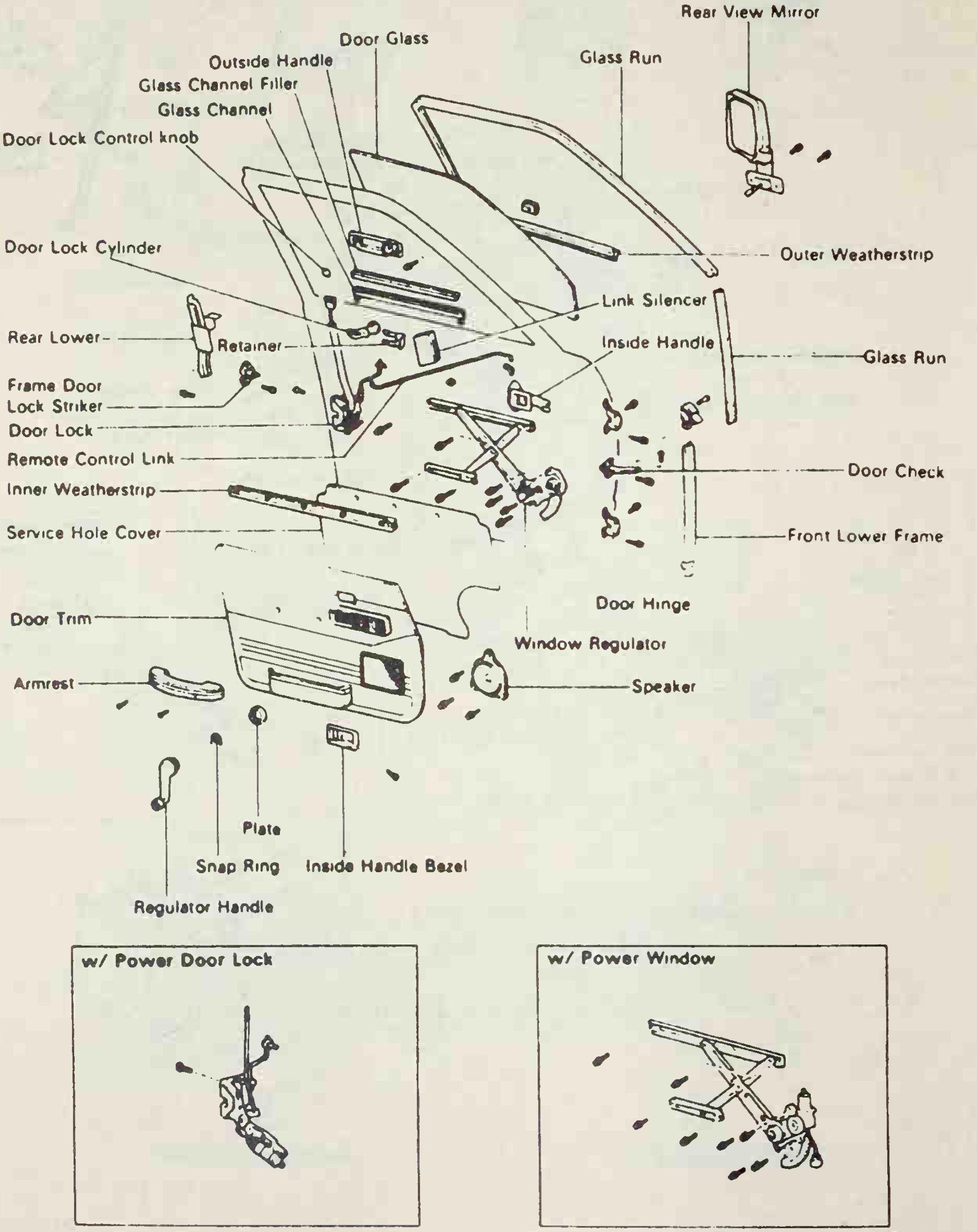

w/ Ventilator Window Type
(w/ Power Door Lock)
Door Glass
Glass Run
Outer Weatherstrip
Outside Handle
Lock Cylinder
Snap Ring
Outer Cover
Rear View Mirror
Ventilator Window
Glass Channel and Weatherstrip
Control Link
Locking Knob
Clamp
Inner Cover
Striker
Mirror Cover
Door Lock
Window Regulator
Door Checker
Rear Lower Frame
Door Hinge
Service Hole Cover
Armrest Panel (2 Door)
Inner Weatherstrip
(w/ Power Window)
(4 Door)
Door Inside Handle
Armrest and Armrest Panel
Cap
Door Trim
Plate
Snap Ring
Clip
Regulator Handle
Door Pocket
Door Trim
Door Trim
Rear Inside Handle
Rear Inside Handle Bezel
2 Door Passenger's
w/ Power Window
86820g73

Fig. 66 Exploded view of the front door with a vent window — 1989-95 4Runner


Snap Ring
Handle
Escutcheon

Alternate methods of removing the window winder clip


Rear View Mirror
Door Glass
Outside Handle
Glass Run
Glass Channel Filler
Glass Channel
Door Lock Control knob
Door Lock Cylinder
Outer Weatherstrip
Link Silencer
Inside Handle
Rear Lower
Retainer
Glass Run
Frame Door
Lock Striker
Door Lock
Remote Control Link
Door Check
Inner Weatherstrip
Service Hole Cover
Front Lower Frame
Door Hinge
Door Trim
Window Regulator
Armrest
Speaker
Plate
Snap Ring
Inside Handle Bezel
Regulator Handle
w/ Power Door Lock
w/ Power Window

86820g74

Fig. 67 Exploded view of the front door — 1989-90 Land Cruiser

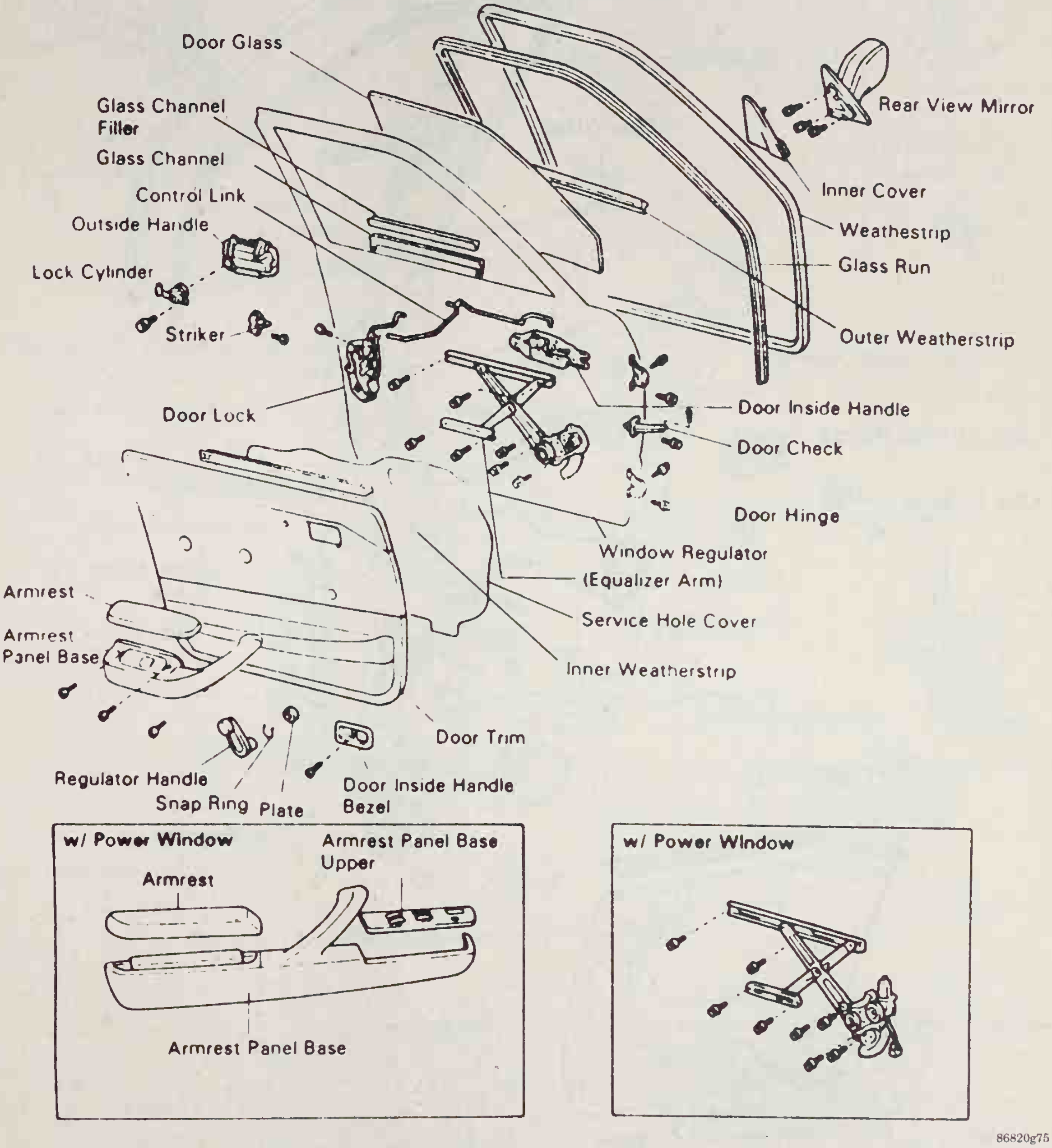

Door Glass
Glass Channel Filler
Glass Channel
Control Link
Outside Handle
Lock Cylinder
Striker
Door Lock
Rear View Mirror
Inner Cover
Weathestrip
Glass Run
Outer Weatherstrip
Door Inside Handle
Door Check
Door Hinge
Window Regulator
(Equalizer Arm)
Service Hole Cover
Inner Weatherstrip
Armrest
Armrest Panel Base
Door Trim
Regulator Handle
Snap Ring
Plate
Door Inside Handle Bezel
w/ Power Window
Armrest
Armrest Panel Base Upper
Armrest Panel Base
w/ Power Window
86820g75

Fig. 68 Exploded view of the front door — 1991-94 Land Cruiser

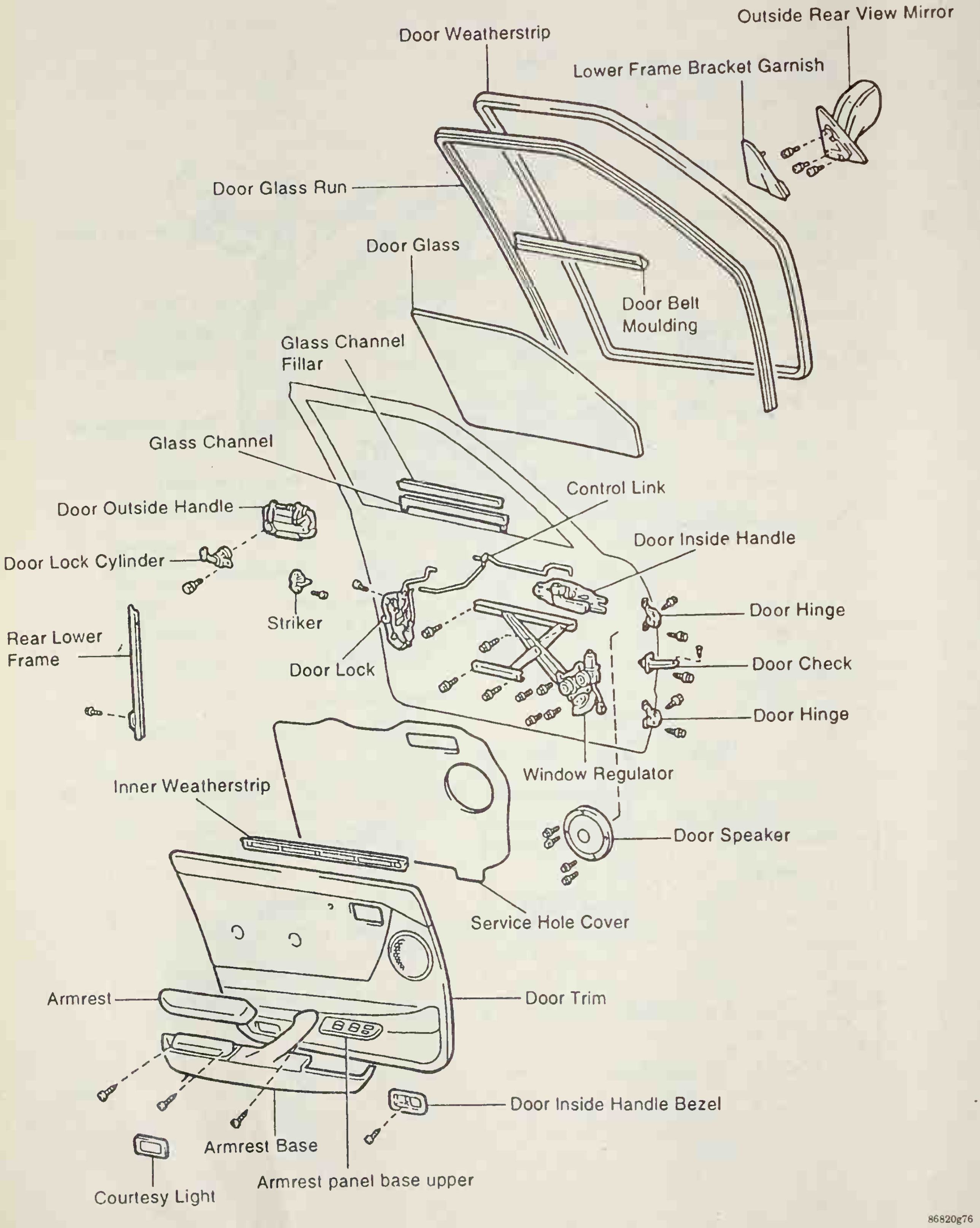
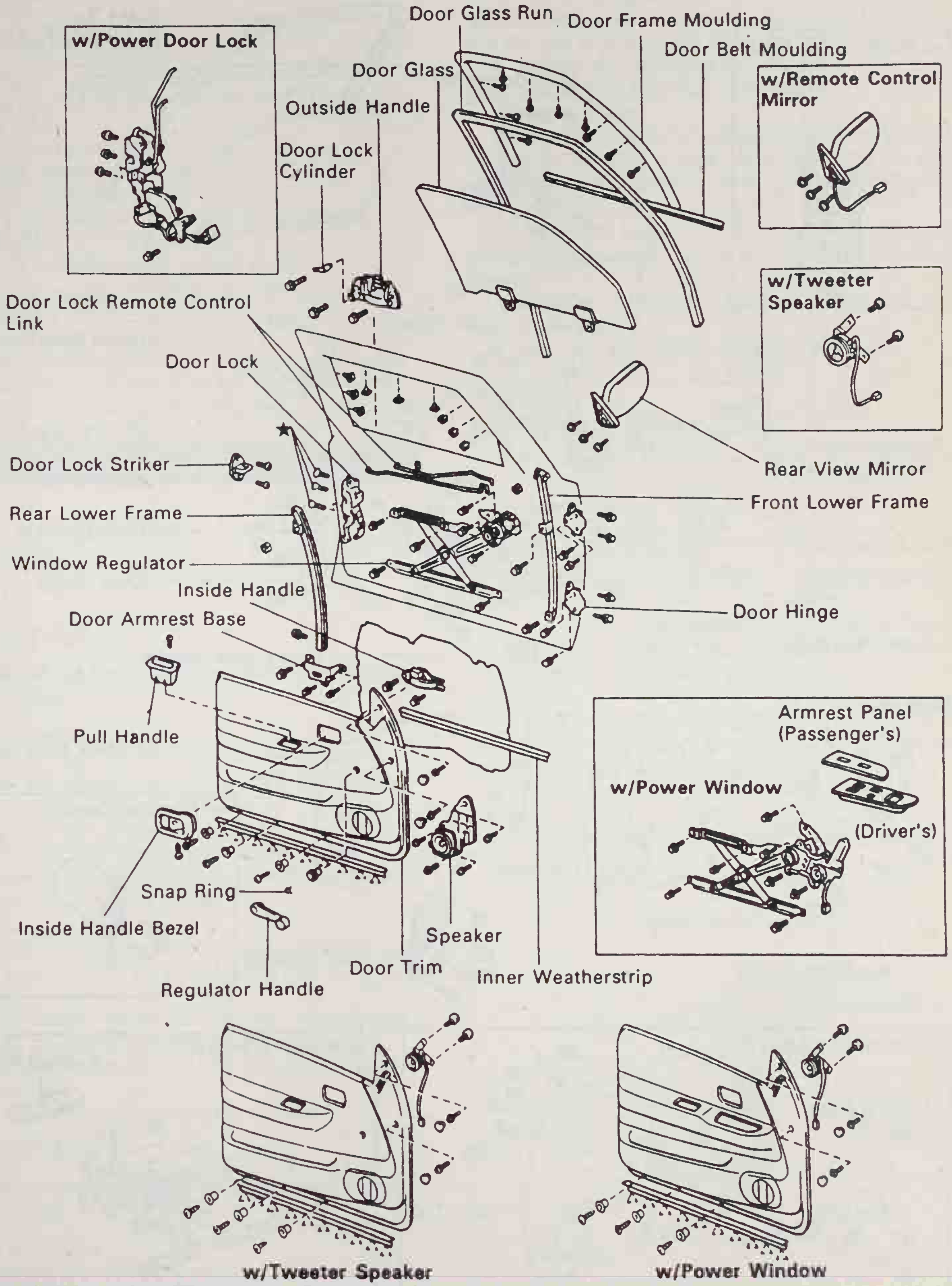

Outside Rear View Mirror
Door Weatherstrip
Lower Frame Bracket Garnish
Door Glass Run
Door Glass
Door Belt
Moulding
Glass Channel
Fillar
Glass Channel
Control Link
Door Outside Handle
Door Inside Handle
Door Lock Cylinder
Striker
Door Hinge
Rear Lower
Frame
Door Lock
Door Check
Door Hinge
Window Regulator
Inner Weatherstrip
Door Speaker
Service Hole Cover
Armrest
Door Trim
Door Inside Handle Bezel
Armrest Base
Armrest panel base upper
Courtesy Light
86820g76

Fig. 69 Exploded view of the front door — 1995-96 Land Cruiser


w/Power Door Lock
Door Glass Run
Door Frame Moulding
Door Belt Moulding
Door Glass
Outside Handle
Door Lock Cylinder
w/Remote Control Mirror
w/Tweeter Speaker
Door Lock Remote Control Link
Door Lock
Door Lock Striker
Rear Lower Frame
Window Regulator
Inside Handle
Door Armrest Base
Pull Handle
Rear View Mirror
Front Lower Frame
Door Hinge
Armrest Panel (Passenger's)
w/Power Window
(Driver's)
Snap Ring
Inside Handle Bezel
Speaker
Regulator Handle
Door Trim
Inner Weatherstrip
w/Tweeter Speaker
w/Power Window

★ Precoated part

86820g77

Fig. 70 Exploded view of the front door — T100

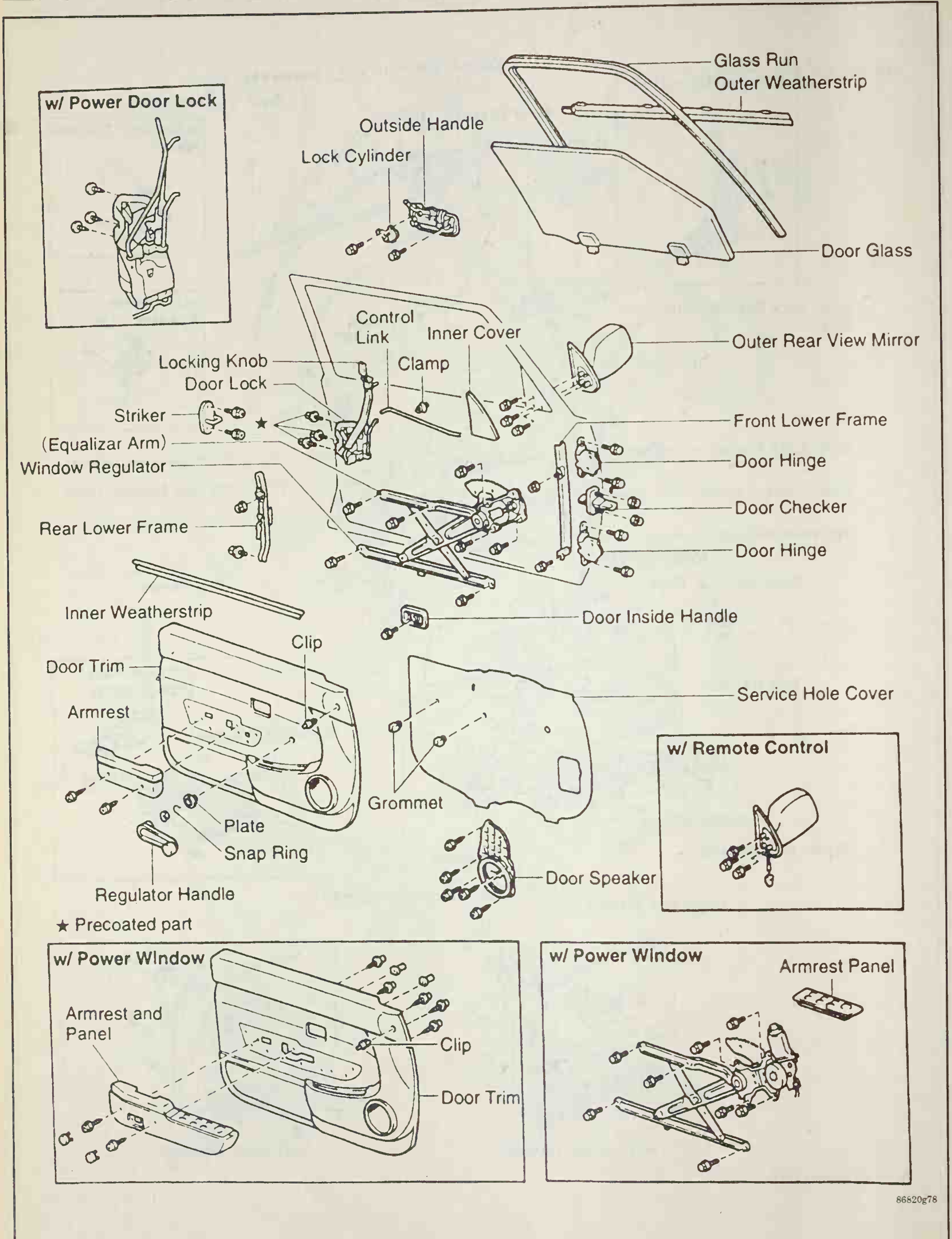

w/ Power Door Lock
Glass Run
Outer Weatherstrip
Outside Handle
Lock Cylinder
Door Glass
Control Link
Inner Cover
Outer Rear View Mirror
Locking Knob
Clamp
Door Lock
Striker
★
Front Lower Frame
(Equalizar Arm)
Window Regulator
Door Hinge
Door Checker
Rear Lower Frame
Door Hinge
Inner Weatherstrip
Door Inside Handle
Clip
Door Trim
Service Hole Cover
Armrest
w/ Remote Control
Grommet
Plate
Snap Ring
Door Speaker
Regulator Handle
★ Precoated part
w/ Power Window
Armrest and Panel
Clip
Door Trim
w/ Power Window
Armrest Panel
86820g78

Fig. 71 Exploded view of the front door — Tacoma

Door Locks

REMOVAL & INSTALLATION

1. Remove the door trim panel and the inner watershield.
2. Disconnect the:
   - Inside locking control link
   - Outside opening control link
   - Outside locking control link
3. Remove the door lock cylinder with a pair of pliers.

To install:

4. Install the lock cylinder and connect the links.
5. Loosen the mounting screws for the inside door handle and push it forward until resistance is felt. Move it backwards slightly and tighten the mounting screws.
6. Disconnect the control link form the outside door handle about 0.004 in. (1mm) from rest. Turn the adjuster on the link until it will fit into the mounting hole of the raised handle.

Door Glass and Regulator

REMOVAL & INSTALLATION

Door Glass

WITHOUT VENT WINDOW

➡If your vehicle has power windows, disconnect the negative battery cable.

1. Lower the window.
2. Remove the door trim panel and the watershield.
3. Unscrew the armrest base and the inside door handle, then remove.
4. Remove the inner and outer weatherstrips.
5. Remove the 2 door glass channel mounting bolts and pull the window up and out of the door. Carefully pry the glass channel from the bottom of the window.

To install:

6. Coat the inside of the weatherstrip with soapy water and tap (with a plastic hammer) the glass channel onto the bottom of the window.
7. Slide the window into the door until the 2 glass channel mounting bolts can be fitted. Tighten the bolts.
8. Install the weatherstrips. Install the armrest base and inside door handle.
9. Install the watershield and the door trim panel.

WITH VENT WINDOW

➡If your vehicle has power windows, disconnect the negative battery cable.

1. Lower the window.
2. Remove the door trim panel and the watershield.
3. Remove the armrest base and the inside door handle.
4. Remove the inner and outer weatherstrips.
5. Remove the glass run and the rear lower frame.
6. Remove the 2 glass channel mounting bolts and place the window on the bottom of the door cavity.
7. Peel off the weatherstrip on the upper side of the vent window. Remove the 3 screws and the division bar set bolt. Pull the vent window up and out of the door frame.
8. Pull the main window up and out of the door. Pry the glass channel from the bottom of the window.

To install:

9. Coat the inside of the weatherstrip with soapy water and carefully tap the glass channel onto the bottom of the window.
10. Slide the main window into the door until the 2 glass channel mounting bolts can be fitted.
11. Position the vent window and install the 3 mounting screws and the set bolt. Tighten the 2 glass channel mounting bolts.
12. Install the weatherstrips. Install the armrest base and inside door handle.
13. Install the watershield and the door trim panel.

Regulator

➧ See Figures 72 and 73

1. If your vehicle has power windows, disconnect the negative battery cable.
2. Remove the door trim panel.
3. Remove the watershield.
4. Remove the window.
5. If the truck has power windows, disconnect the electrical lead from the motor.
6. Remove the regulator mounting bolts, then lift the regulator out through the service hole. On models without a vent window, remove the 2 equalizer arm bracket mounting bolts.

To install:

7. Install the regulator and tighten the mounting bolts to 43 inch lbs. (5 Nm. On models with a vent window, install the 2 equalizer arm bracket mounting bolts.
8. Connect the lead to the power window motor if equipped.
9. Install the window, watershield and door trim panel.

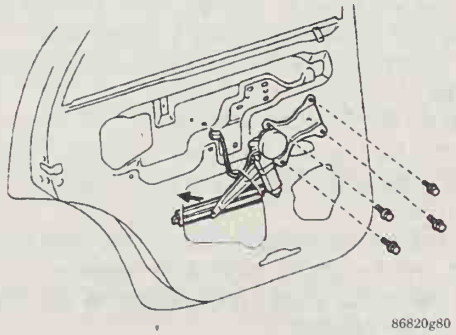


Fig. 72 Remove the mounting bolts for the window regulator

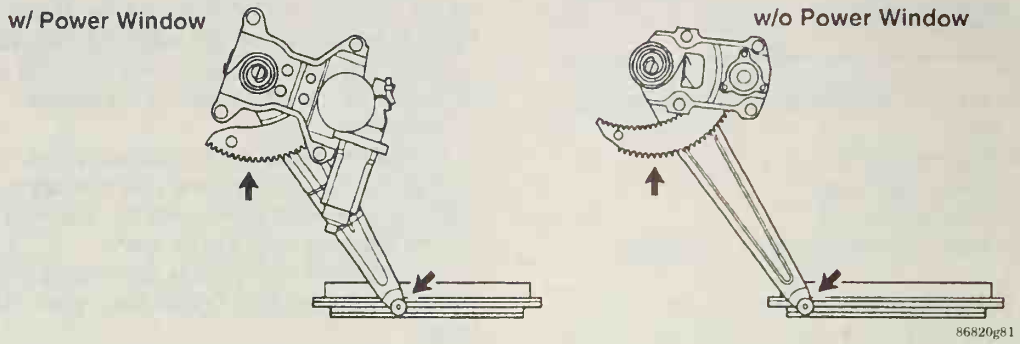


Fig. 73 Apply multi-purpose grease to the regulator in the arrowed parts

Tailgate Window

REMOVAL & INSTALLATION

1. Remove the inner tailgate trim.
2. Remove the tailgate plate and the watershield.
3. Disconnect the control link for the inside handle at the regulator, remove the 2 mounting screws and lift out the door handle.
4. Disconnect the inside lock knob link at the regulator and remove the knob and link.
5. Remove the upper door trim and the weatherstripping.
6. Move the locking assembly into the locked position and then raise the rear window until the regulator arms are in a straight line.
7. Disconnect the electrical lead at the regulator. Disconnect the leads for the rear defogger at the window.
8. Disconnect the door lock control cables at the regulator side. Disconnect the 2 remaining leads and the ground cable at the regulator.
9. Remove the regulator mounting bolts and then shimmy it side-to-side until the arms pull away from the glass.
10. Pull out the rear window and remove the regulator.

To install:

11. Slide the window into the tailgate.
12. Shimmy the regulator side-to-side until the arms position themselves in the glass channel and then install the regulator mounting bolts.
13. Connect the rear defogger leads to the window. Connect the 2 leads and the ground cable at the regulator.
14. Use the original clamps and connect the door lock control cables to the regulator.
15. Connect the power lead to the regulator.
16. Install the upper tailgate trim and weatherstripping.
17. Install the inside lock knob and link.
18. Install the inside handle and connect the control link to the regulator.
19. Seal the watershield with butyl tape 0.2 in. (6mm) in width. Insert the lower edge into the panel slit and then seal the slit with cotton tape being careful not to block the trim clip seats.
20. Install the plate and lower tailgate trim.

Windshield Glass

REMOVAL & INSTALLATION

See Figures 74, 75, 76, 77, 78, 79, 80 and 81

Some models use a glue-in windshield. Special adhesives, primers and cleaners must be used; the integrity and water seal of the glass depends entirely on the installation. Removal and replacement of this type of windshield is generally not within the ability of the owner/mechanic; a slight error can result in a water leak or a shattered windshield. Additionally, adhesive-mounted windshields add strength to the roof and pillars if the vehicle rolls over so a poor installation has safety implications as well.

Replacement of this type of glass is best referred to an installer. In many cases, the vehicle is returned clean and ready the same day.

An assistant and the following supplies are required. Have them present before beginning the procedure:

- Weatherstrip cleaner
- Weatherstrip primer
- Primer solvent — Toluene (see caution)
- Cemedine 366ET, DuPont Imron Sealant or an equivalent weatherstrip adhesive

- Piano wire or other thin, strong wire
- Two hand-sized blocks of wood
- Sash cord or thin clothesline
- A small amount of clean kerosene

✱✱CAUTION

The chemicals and solvents in use are flammable and create vapors which may explode if exposed to heat, sparks or flame. Additionally, the vapors may be toxic or cause allergic reactions. Work only in an open, well-ventilated area and avoid exposure to fumes. Keep containers capped at all times when not in use. Wear rubber gloves and eye protection when chemicals are in use.

1. Remove the sunvisors, holders, inside mirror, wiper arms and the cowl cover at the base of the windshield.
2. On Land Cruiser remove the hood, accessory meter and roof console.
3. Remove the windshield outside mouldings. A few clips may break in the process so be prepared to acquire replacements.
4. On the outside, use a sharp tool to cut off the lip of the weatherstrip that overlaps the glass. Do not damage the bodywork or paint.
5. Push a piece of piano wire through from the inside.
6. Tie the ends of the wire securely to the wood blocks, one inside and one outside.
7. Place a piece of plastic on the dash to protect the vinyl and trim. Move the plastic along as the wood and wire is pulled.
8. Cut the adhesive holding the weatherstrip by pulling on the wood handles and moving around the windshield. An assistant inside makes this a lot easier. Exercise great care not to damage interior or exterior trim or paintwork.
9. When the adhesive has been cut all the way around, remove the windshield by pressing gently from the inside. If the windshield is to be reused, store it out of the work area in a safe location; protect it with blankets or pads. Use a scraper to remove the adhesive. Clean the glass with glass cleaner.

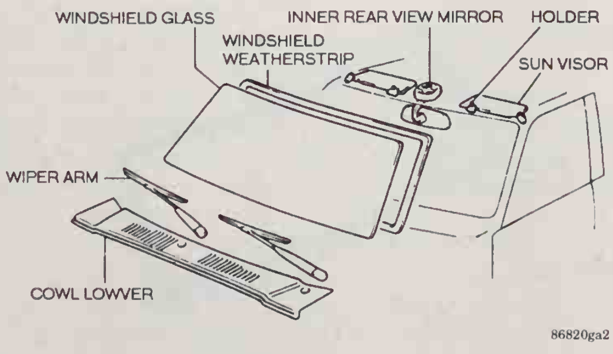


Fig. 74 Exploded view of the windshield and nearby components — Pick-Up shown

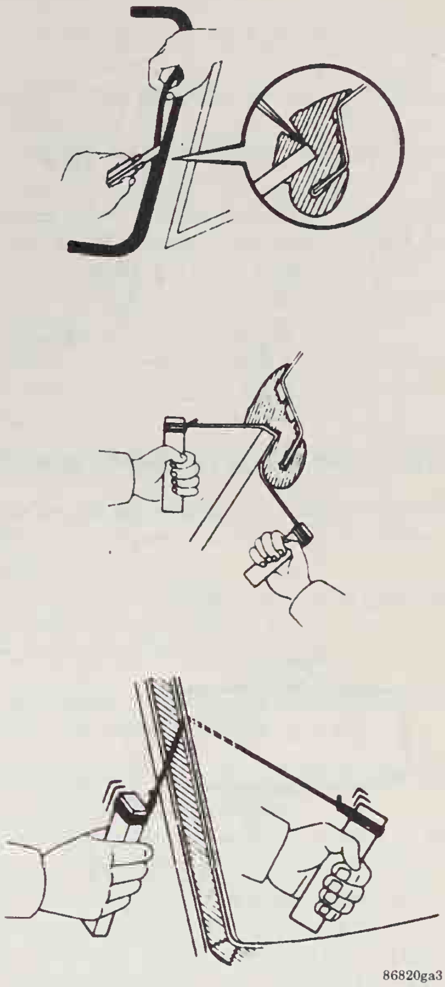


Fig. 75 Steps in removing the windshield with piano wire

To install:

10. Use the weatherstrip cleaner to clean the contact surfaces of the body and the glass.
11. Saturate a piece of cloth with cleaner. Clean the weatherstrip surfaces with particular attention to getting all the way to the bottom of the grooves and completely cleaning the sides of the channels. Allow the primer to dry for at least 3 minutes; longer is better.
12. Coat the contact surfaces of the weatherstrip (the channels) with the primer; allow the primer to dry at least 15 minutes. Be careful not to touch the coated portions of the weatherstrip.
13. Attach the weatherstrip to the windshield. Install a length of rope around the weatherstrip. Provide a loop at the top and overlap the ends at the bottom.
14. Coat area (C) of the weatherstrip with clean kerosene. Do not use soapy water.
15. Hold the glass in position on the body. Begin installation in the middle of the lower part of the glass.
16. From the inside, pull on one cord (at an angle) so that it will pass over the flange. From the outside, tap the glass

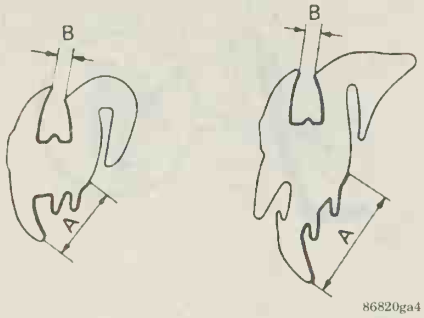


Fig. 76 Areas A and B must be carefully cleaned and primed

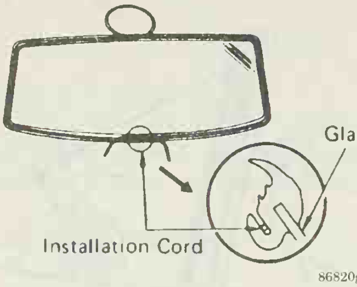


Fig. 77 The installation cord helps fit the weatherstrip over the body flanges

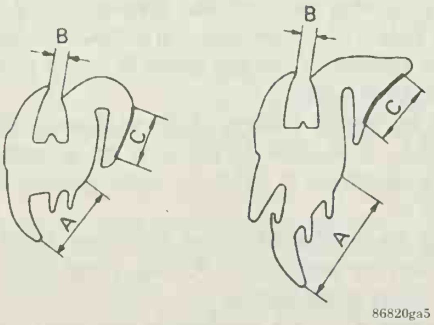


Fig. 78 Coat area C of the weatherstrip with clean kerosene

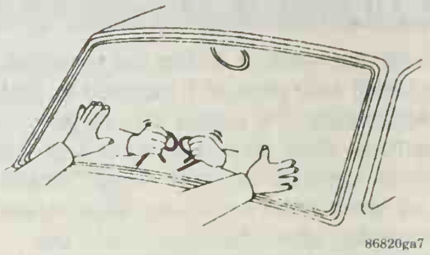


Fig. 79 With the aid of a helper, position the glass

along the weatherstrip with open hands until the glass is installed. Continue pulling on the cord around the glass.

17. Snug the glass by tapping from the outside with open palms.

18. Place masking tape above the outer edge of the weatherstrip all around. Place a second layer of tape on the glass, inboard of the weatherstrip.

19. Apply adhesive all around at the glass lip at the weatherstrip until it oozes out. Apply adhesive to the weatherstrip-to-body lip all around EXCEPT at the lower corner sections until it oozes out.

20. The adhesive will harden in about 15 minutes, depending on temperature. When the adhesive is dry, remove the masking tape. Use a rag soaked in cleaner to remove the excess adhesive.

21. Allow the adhesive to set for an hour. Water test the windshield for leaks. Seal any leaks with adhesive (dry the area first).

22. Install the cowl cover, wiper arms, inside mirror, sunvisors and holders. Install the hood, accessory motor and roof console.

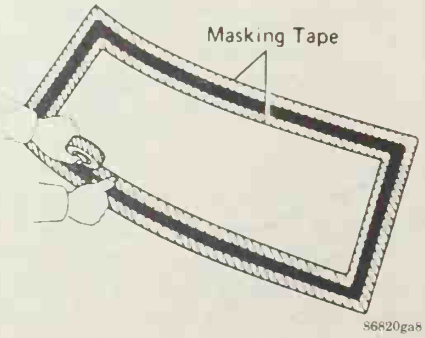


Fig. 80 Apply double layers of masking tape to protect the bodywork and glass

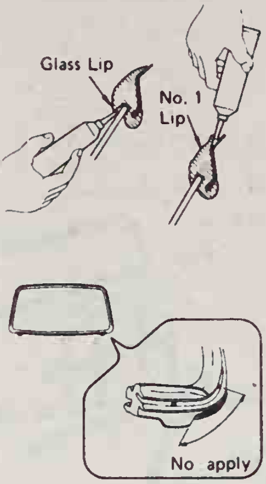


Fig. 81 Apply adhesive to the correct areas

Rear Quarter Window and Rear Windshield

REMOVAL & INSTALLATION

Pick-Up

➧ See Figure 82

➡You'll need an assistant for this job.

1. Have your assistant stand outside and support the glass.
2. Working from inside the truck, start at one upper corner and work the weatherstripping across the top of the glass, pulling the weatherstripping down and pushing outward on the glass until your assistant can grab the glass and lift it out.
3. Remove the moldings.
4. Remove the weatherstripping from the glass.

To install:

5. Clean the weatherstripping, glass and glass opening with solvent to remove all old sealer.
6. Apply liquid butyl sealer in the glass channel of the weatherstripping and install the weatherstripping on the glass.
7. Install the moldings.
8. Apply a bead of sealer to the opening flange and in the inner flange crevice of the weatherstripping lip.
9. Place a length of strong cord, such as butcher's twine, in the flange crevice of the weatherstripping. The cord should go all the way around the weatherstripping with the ends, about 18 in. (46cm) long each, hanging down together at the bottom center of the window.
10. Apply soapy water to the weatherstripping lip.
11. Have your assistant position the window assembly in the channel from the outside, applying firm inward pressure.
12. From inside, guide the lip of the weatherstripping into place using the cord, working each end alternately, until the window is locked in place.
13. Remove the cord, clean the glass and weatherstripping of excess sealer and leak test the window.

Land Cruiser

➧ See Figure 83

1. Remove the rear seat, back door scuff plate and quarter trim.
2. Detach the rear seat side garnish and remove the rear door scuff plate.
3. Carefully pry the quarter pillar and rear quarter garnishes. Unscrew the assist grips.
4. Remove the vent louver and quarter belt moulding. Remove the nut from the louver, then insert a tool between the retainers and the body and pry it loose.
5. Remove the vent louver. Pull out the clips from the edge of the panel, then remove the moulding.
6. Pry the lip of the weatherstrip outwards from the interior part of the body. Pull the glass outwards, then remove it with the weatherstrip.
7. If using a new weatherstrip, from the outside of the vehicle, cut off the weatherstrip lip with a blade.
8. Push the glass outwards with a helper behind the glass and remove.

To install:

9. Clean the weatherstripping, glass and glass opening with solvent to remove all old sealer.
10. Attach the weatherstrip to the glass.

➡If the old weatherstripping has hardened, it may develop leaks. Use a new one if possible.

11. Insert a cord into the groove of the weatherstrip all the way around with the ends overlapping.
12. Apply soapy water to the contact surface of the weatherstrip lip and to the body flange. Begin the installation in the middle of the lower part of the quarter window glass.
13. Hold the glass into position on the body.
14. From the inside, pull on one cord at an angle so it pulls the lip over the flange. From the outside of the vehicle, press the glass along the weatherstrip until the glass is installed.
15. To make the glass fit snugly, tap from the outside with your open hand. But not too hard.
16. Leak test the window. Seal any leaks with auto glass sealer.
17. Install the various body parts removed.

DISASSEMBLY

➡This applies to sliding rear windows found on Pick-Ups and 4Runners.

1. Remove the rear windshield.
2. Remove the sliding glass stopper from the window frame.
3. Remove the mounting screws for the 2 center support frames.
4. While pulling the upper and lower window frame apart, slide the glass into the center of the window and remove each sliding pane from the frame.
5. Pull apart the upper and lower frame again and remove the 2 center supports. Slide the stationary glass into the center of the frame and remove it. Repeat for the other side.

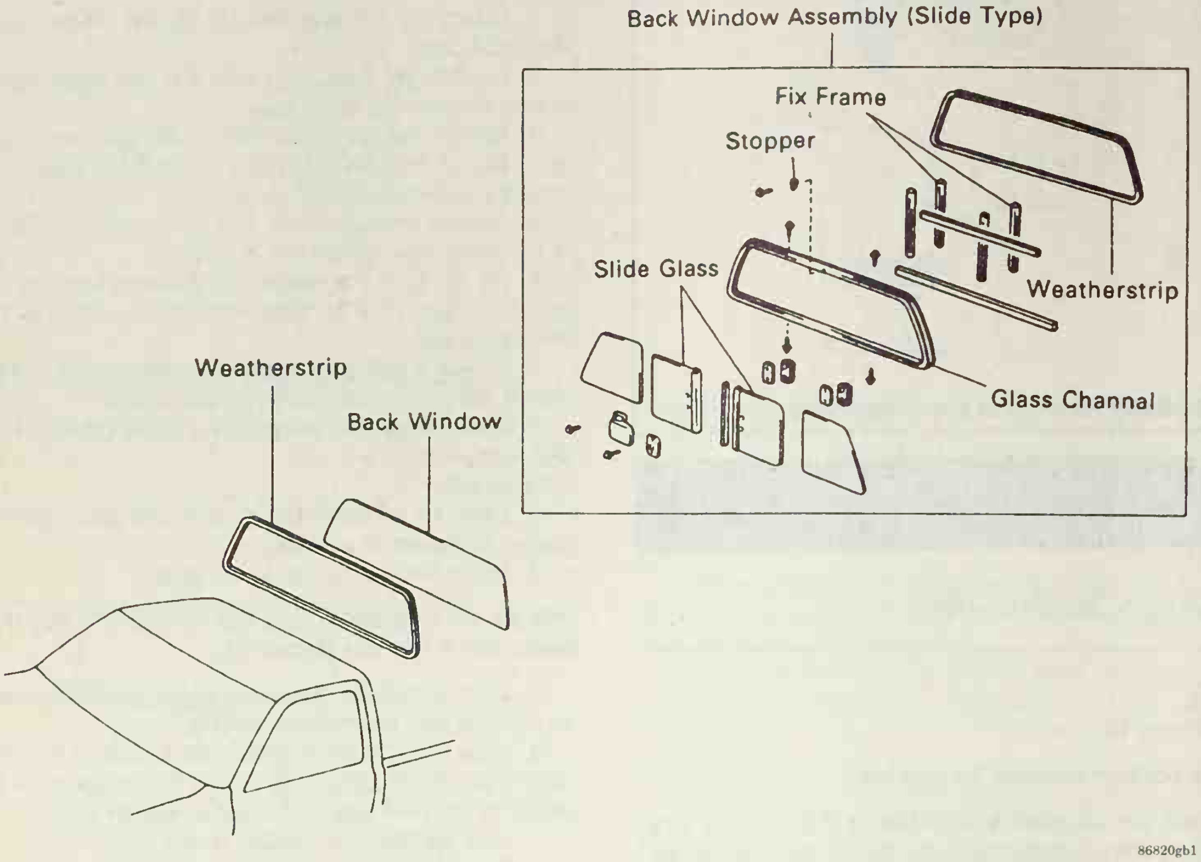

Back Window Assembly (Slide Type)
Fix Frame
Stopper
Slide Glass
Weatherstrip
Glass Channal
Weatherstrip
Back Window
86820gb1

Fig. 82 Exploded view of the rear window glass and associated parts on trucks — with or without sliding glass

To assemble:

6. Coat the mating surfaces of the window frame and the weatherstripping with soapy water and slide the 2 stationary window halves into position.

7. Install the 2 center support frames.

8. Install the sliding glass halves, tighten the center frame mounting screws and install the window stopper.

9. Install the entire assembly.

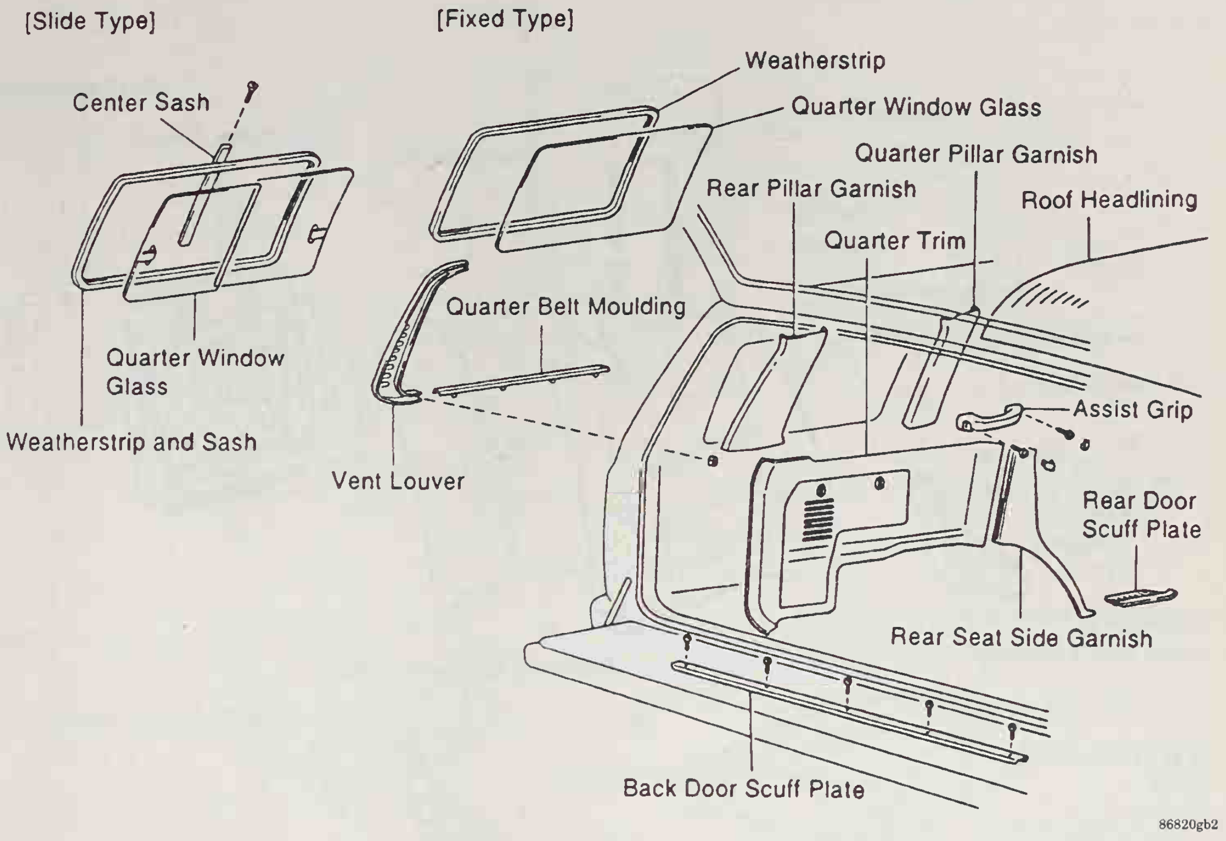

[Slide Type]
[Fixed Type]
Center Sash
Weatherstrip
Quarter Window Glass
Quarter Pillar Garnish
Rear Pillar Garnish
Roof Headlining
Quarter Trim
Quarter Belt Moulding
Quarter Window Glass
Weatherstrip and Sash
Vent Louver
Assist Grip
Rear Door Scuff Plate
Rear Seat Side Garnish
Back Door Scuff Plate
86820gb2

Fig. 83 Exploded view of the rear quarter glass — Land Cruiser

Seats

REMOVAL & INSTALLATION

Front

➧ See Figures 84, 85, 86, 87 and 88

1. Lift the carpet in any areas covering the seat track areas.
2. Remove the seat track-to-floor pan bolts and lift out the seat.

To install:

3. Apply sealer to the hole areas and install the seat.
4. Tighten the bolts to 25-33 ft. lbs. (34-45 Nm).
5. Place any carpeting back into position.

Rear

➧ See Figures 89, 90 and 91

1. Release the seat back locks on each side of the seat.
2. Remove the covers and remove the bolts holding the front of the seat bottom to the floor pan. On 4Runner, doing this removes only the seat bottom. Remove the seat back by removing the center hinge bolts and the pivot bolts at either side. Remove the seat and seat back.

To install:

3. Apply sealer to the hole areas and install the seat and back. Tighten the bolts. Tighten the bolts holding the seat to the floor to 13-29 ft. lbs. (18-39 Nm).

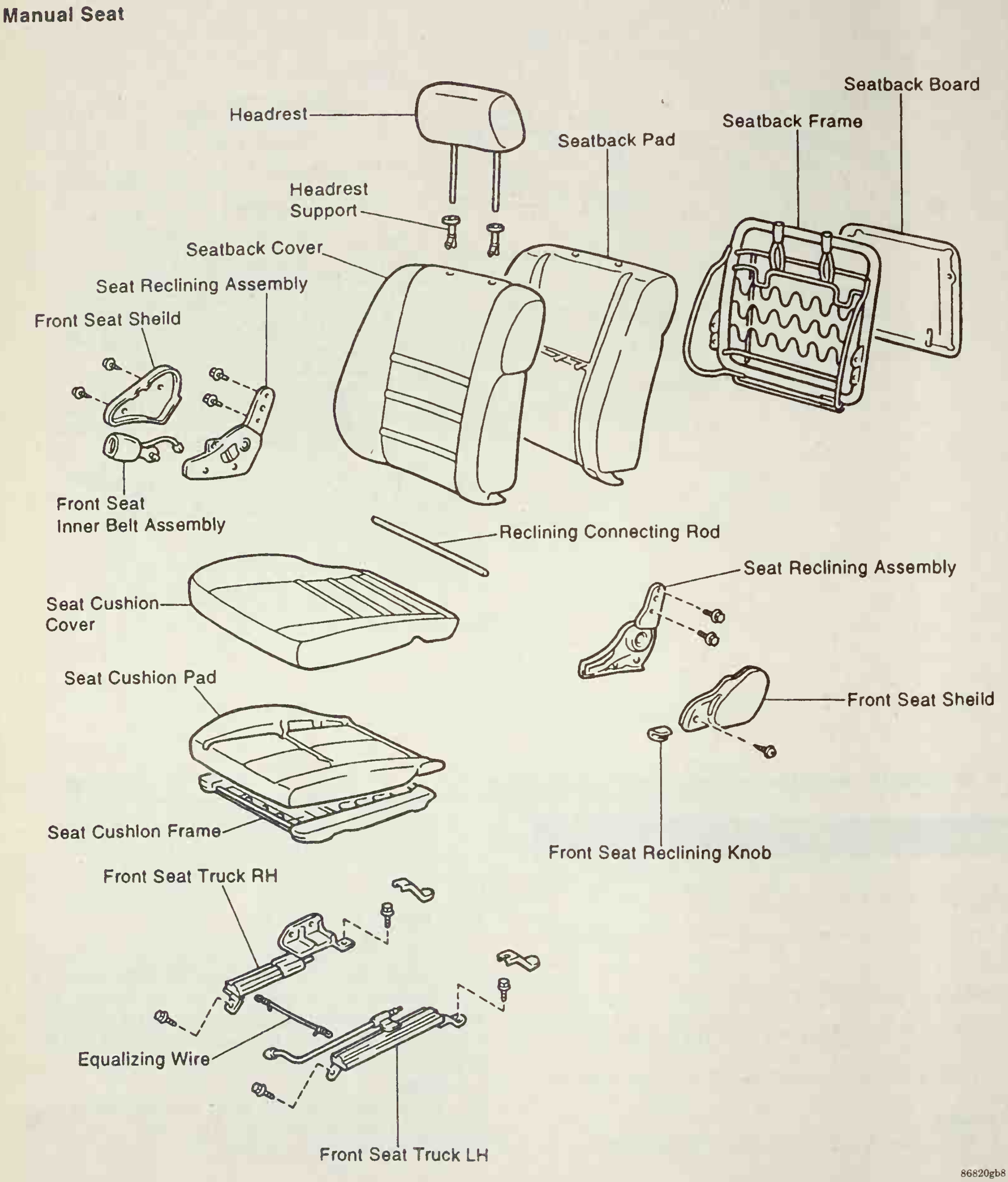

Manual Seat
Headrest
Seatback Board
Seatback Frame
Seatback Pad
Headrest Support
Seatback Cover
Seat Reclining Assembly
Front Seat Sheild
Front Seat Inner Belt Assembly
Reclining Connecting Rod
Seat Reclining Assembly
Seat Cushion Cover
Front Seat Sheild
Seat Cushion Pad
Seat Cushion Frame
Front Seat Reclining Knob
Front Seat Truck RH
Equalizing Wire
Front Seat Truck LH
86820gb8

Fig. 84 Exploded view of the manual front seat components — Land Cruiser

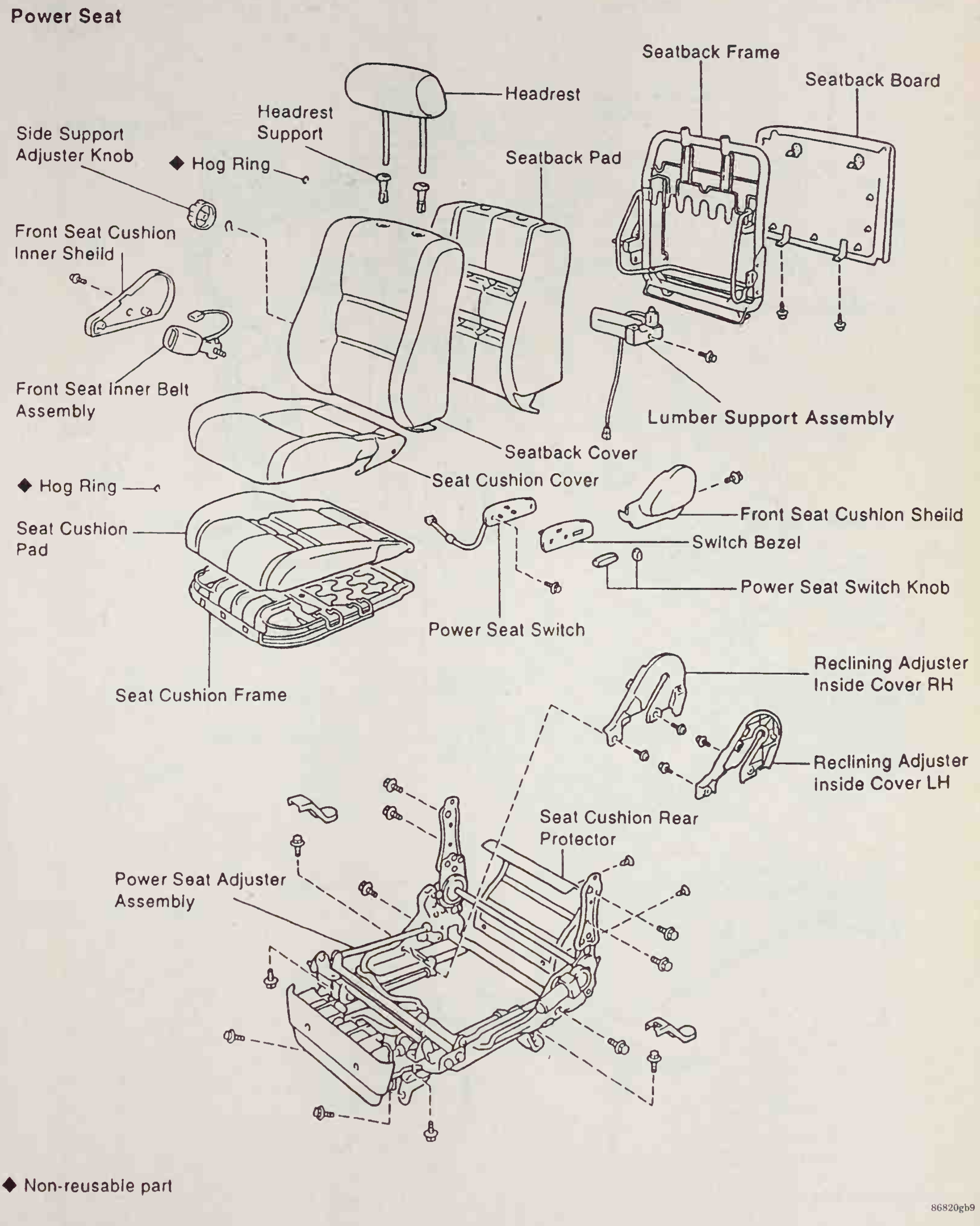

Power Seat
Seatback Frame
Seatback Board
Headrest
Headrest Support
Side Support Adjuster Knob
◆ Hog Ring
Seatback Pad
Front Seat Cushion Inner Sheild
Front Seat Inner Belt Assembly
Lumber Support Assembly
Seatback Cover
Seat Cushion Cover
◆ Hog Ring
Front Seat Cushion Sheild
Seat Cushion Pad
Switch Bezel
Power Seat Switch Knob
Power Seat Switch
Seat Cushion Frame
Reclining Adjuster Inside Cover RH
Reclining Adjuster inside Cover LH
Seat Cushion Rear Protector
Power Seat Adjuster Assembly
◆ Non-reusable part
86820gb9

Fig. 85 Exploded view of the power seat components — Land Cruiser

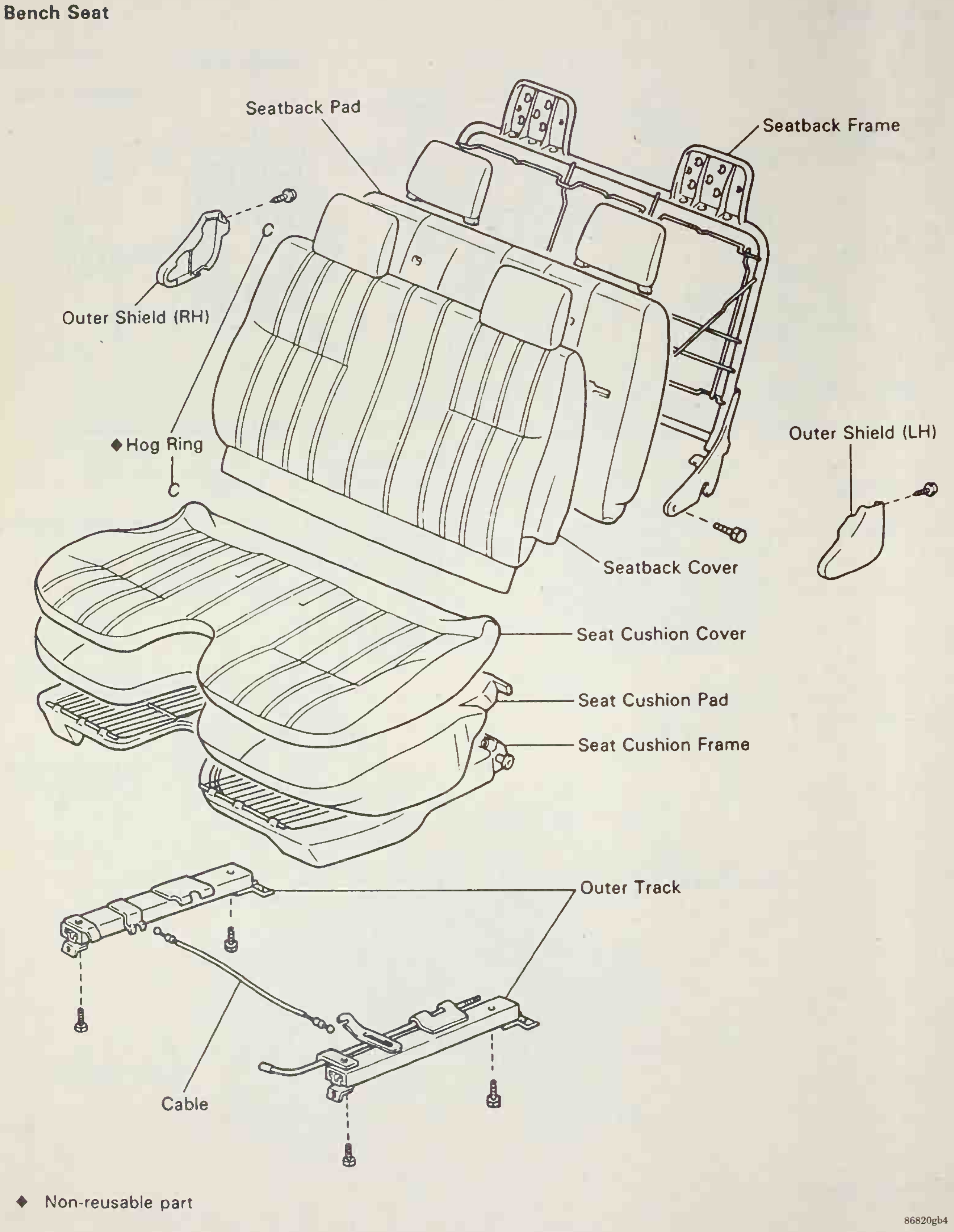

Bench Seat
Seatback Pad
Seatback Frame
Outer Shield (RH)
◆Hog Ring
Outer Shield (LH)
Seatback Cover
Seat Cushion Cover
Seat Cushion Pad
Seat Cushion Frame
Outer Track
Cable
◆ Non-reusable part
86820gb4

Fig. 86 Exploded view of the bench seat components — Tacoma

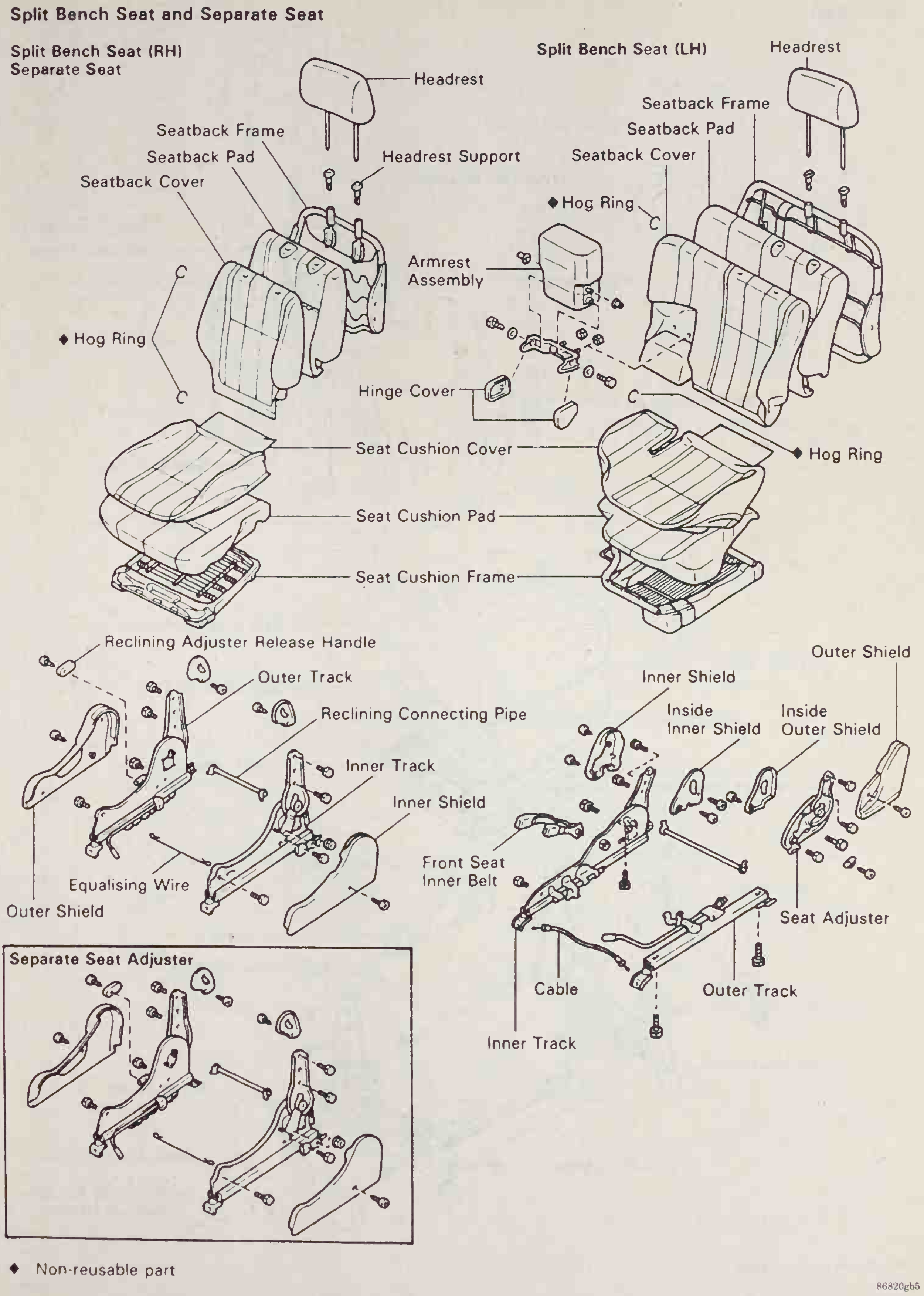

Split Bench Seat and Separate Seat
Split Bench Seat (RH)
Separate Seat
Headrest
Seatback Frame
Seatback Pad
Headrest Support
Seatback Cover
◆ Hog Ring
Split Bench Seat (LH)
Headrest
Seatback Frame
Seatback Pad
Seatback Cover
◆ Hog Ring
Armrest Assembly
Hinge Cover
◆ Hog Ring
Seat Cushion Cover
Seat Cushion Pad
Seat Cushion Frame
Reclining Adjuster Release Handle
Outer Track
Reclining Connecting Pipe
Inner Track
Inner Shield
Equalising Wire
Outer Shield
Outer Shield
Inner Shield
Inside Inner Shield
Inside Outer Shield
Front Seat Inner Belt
Seat Adjuster
Cable
Outer Track
Inner Track
Separate Seat Adjuster
◆ Non-reusable part
86820gb5

Fig. 87 Exploded view of the split-bench and separate seat components — Tacoma

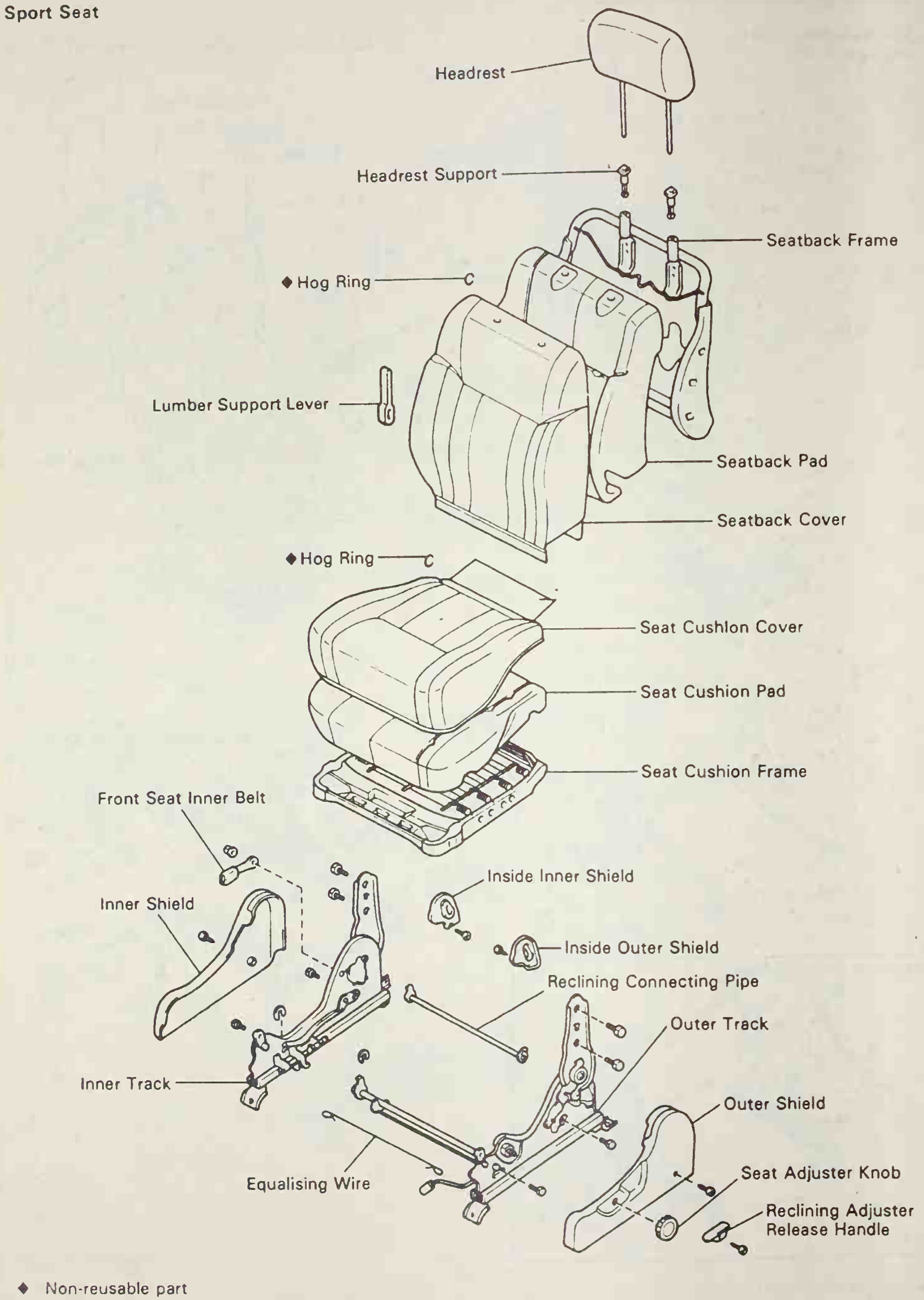

Sport Seat
Headrest
Headrest Support
Seatback Frame
◆ Hog Ring
Lumber Support Lever
Seatback Pad
Seatback Cover
◆ Hog Ring
Seat Cushion Cover
Seat Cushion Pad
Seat Cushion Frame
Front Seat Inner Belt
Inside Inner Shield
Inner Shield
Inside Outer Shield
Reclining Connecting Pipe
Outer Track
Inner Track
Outer Shield
Equalising Wire
Seat Adjuster Knob
Reclining Adjuster Release Handle
◆ Non-reusable part
86820gb6

Fig. 88 Exploded view of the sport seat components — Tacoma

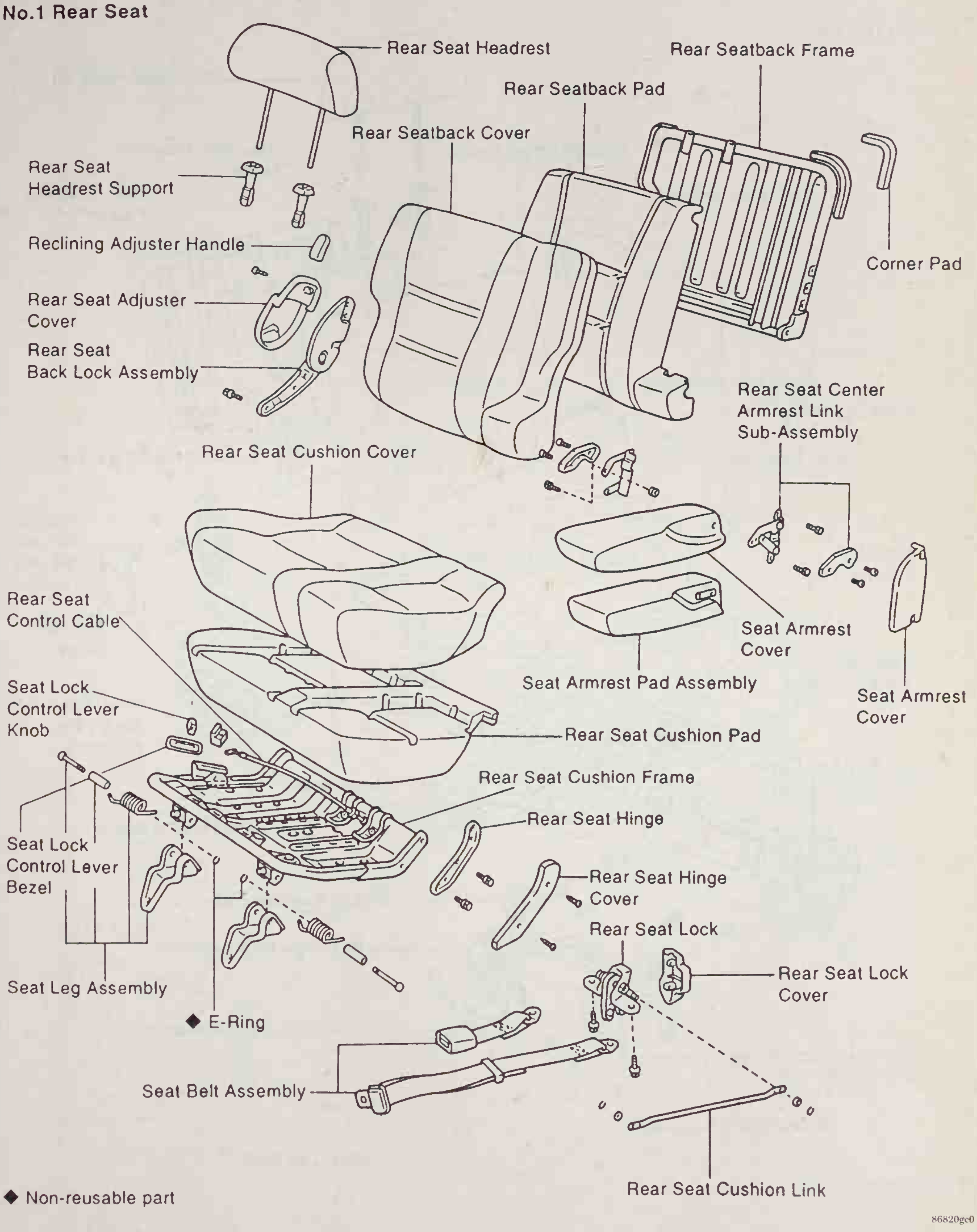

No.1 Rear Seat
Rear Seat Headrest
Rear Seatback Frame
Rear Seatback Pad
Rear Seatback Cover
Rear Seat Headrest Support
Reclining Adjuster Handle
Corner Pad
Rear Seat Adjuster Cover
Rear Seat Back Lock Assembly
Rear Seat Center Armrest Link Sub-Assembly
Rear Seat Cushion Cover
Rear Seat Control Cable
Seat Armrest Cover
Seat Armrest Pad Assembly
Seat Armrest Cover
Seat Lock Control Lever Knob
Rear Seat Cushion Pad
Rear Seat Cushion Frame
Rear Seat Hinge
Seat Lock Control Lever Bezel
Rear Seat Hinge Cover
Rear Seat Lock
Rear Seat Lock Cover
Seat Leg Assembly
◆ E-Ring
Seat Belt Assembly
Rear Seat Cushion Link
◆ Non-reusable part
86820gc0

Fig. 89 Exploded view of the 2nd rear seat and components — Land Cruiser

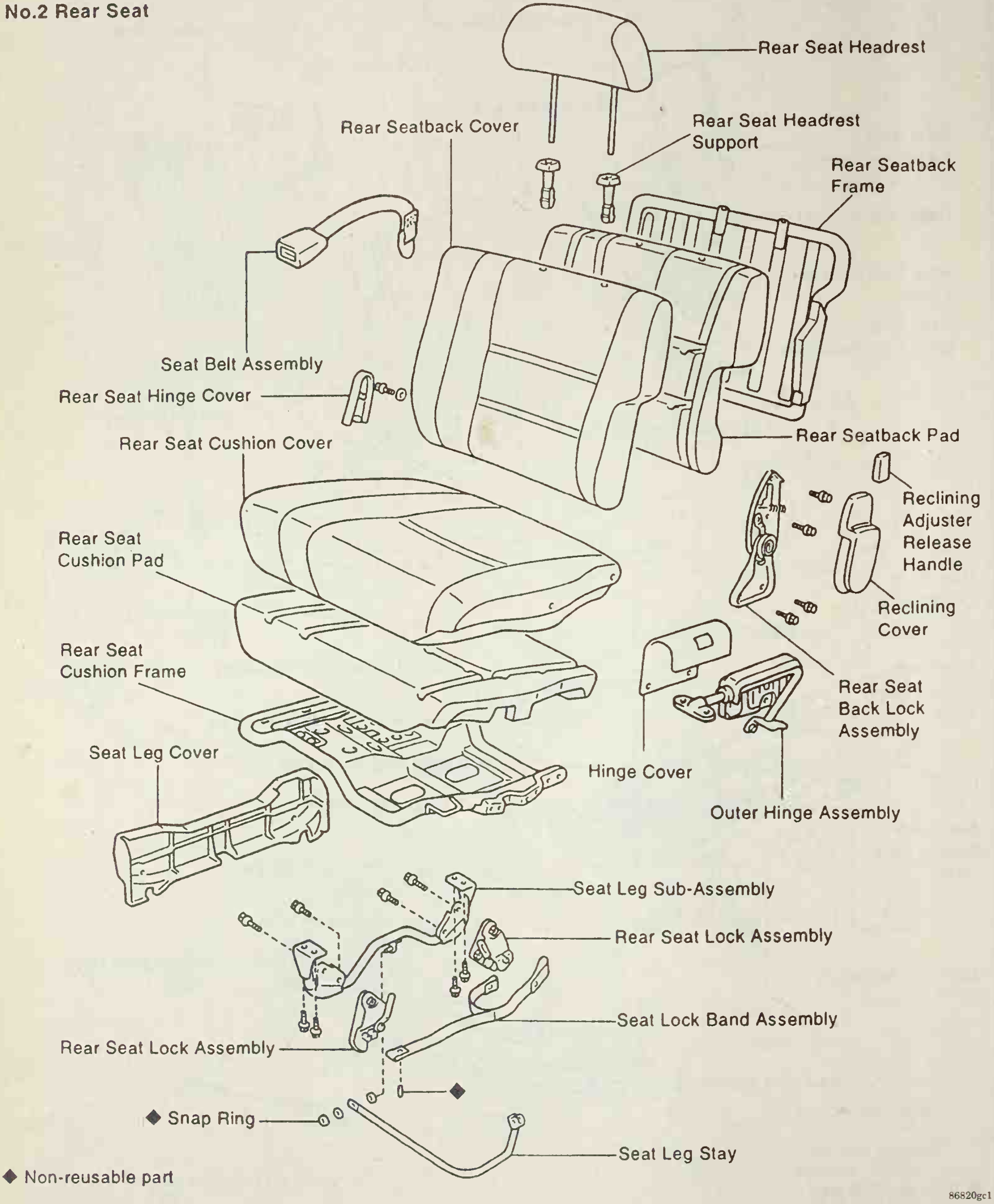

No.2 Rear Seat
Rear Seat Headrest
Rear Seatback Cover
Rear Seat Headrest Support
Rear Seatback Frame
Seat Belt Assembly
Rear Seat Hinge Cover
Rear Seat Cushion Cover
Rear Seatback Pad
Reclining Adjuster Release Handle
Rear Seat Cushion Pad
Reclining Cover
Rear Seat Cushion Frame
Rear Seat Back Lock Assembly
Seat Leg Cover
Hinge Cover
Outer Hinge Assembly
Seat Leg Sub-Assembly
Rear Seat Lock Assembly
Seat Lock Band Assembly
Rear Seat Lock Assembly
◆ Snap Ring
Seat Leg Stay
◆ Non-reusable part
86820gc1

Fig. 90 Exploded view of the 3rd rear seat and components — Land Cruiser

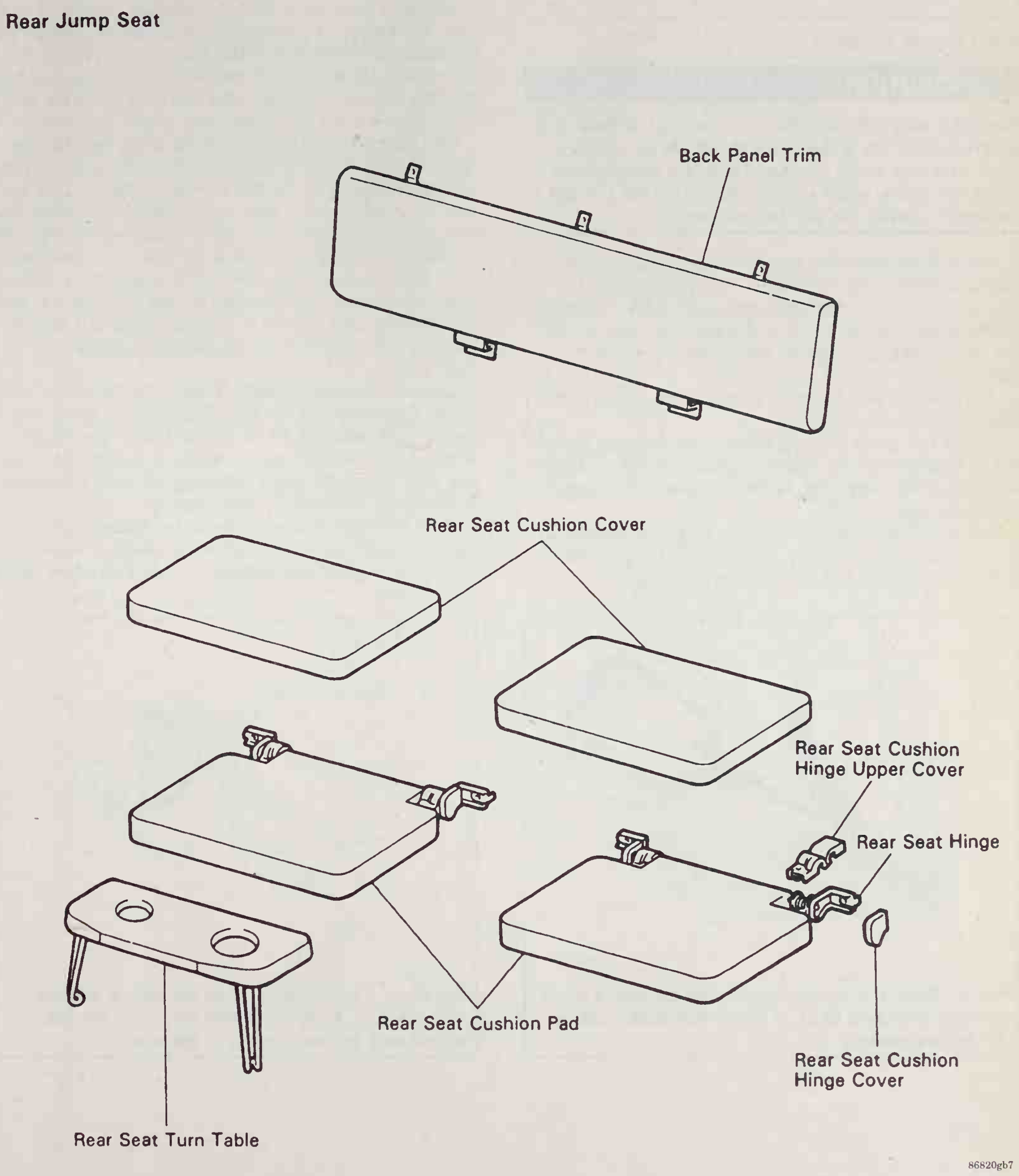

Rear Jump Seat
Back Panel Trim
Rear Seat Cushion Cover
Rear Seat Cushion Hinge Upper Cover
Rear Seat Hinge
Rear Seat Cushion Pad
Rear Seat Cushion Hinge Cover
Rear Seat Turn Table
86820gb7

Fig. 91 Exploded view of the rear jump seat components — Pick-Ups, T100's and Tacomas

Seat Belts

TESTING

➧ See Figures 92 and 93

⁂CAUTION

Replace a seat belt assembly if the vehicle has been in a severe impact. The entire assembly should be replaced even if damage is not obvious. There is a warning label under the sleeve which specifies REPLACE BELT. If this is noticeable, replace the belt immediately.

The retracting seat belts used in Toyota vehicles may be tested for function without removal. The spools rely on an internal pendulum mechanism to lock under sudden deceleration or impact. The old test of pulling sharply on the belt will not cause it to lock; it must be tested with the vehicle in motion.

1. Fasten the seat belt while in your normal driving position.
2. The belt should be snug against your chest and lap. In a safe location, drive the vehicle at about 10 mph. (16 km/h). Apply the brakes very hard; the belt should lock and restrain you in the seat.

To test lap belts, simply connect the buckle (as it would be in use) and apply firm force to either side of the belt. There should be no slippage of the belt through the adjuster.

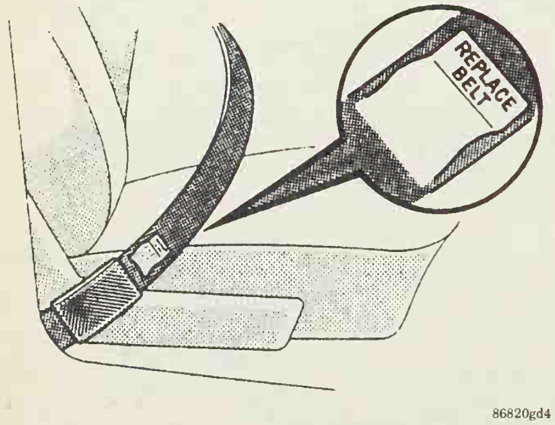


Fig. 92 There is a warning label under the sleeve which specifies REPLACE BELT. If this is noticeable, replace the belt immediately

REMOVAL & INSTALLATION

➧ See Figures 94, 95, 96, 97, 98, 99 and 100

Seat belts are a safety item; the continued success of your face (and the rest of you) depends on the proper removal and installation of the belt assemblies. Use only wrenches of the correct size. Never substitute bolts when reinstalling; seat belt retaining bolts are of specific sizes and materials. Make certain every washer, shim, etc., is reinstalled exactly as it was.

Seat belt removal is simple once you get to the bolts. Removal of seats, interior panels and possibly the carpet will be required depending on the belt. Removing interior panels can turn into a major project, since panels adjoin and overlap. Be very careful during panel removal not to damage the clips and hardware holding the panel. Never force or pry a panel that won't come loose. Instead, look for the hidden clip or screw. If necessary, diagram the placement of clips and retainers. When reassembling, take the time to fit every retainer and align the panel correctly. The one you skip will cause a squeak on every bump.

Lap belt halves are generally bolted to the floorpan or center hump. If removing front lap belts, disconnect the wiring connector at the bottom of the buckle half before removing the retaining bolt. Retractor belts are bolted at both the floor and to a pillar or roof rail. Again, front belts will have a connector at the winder; disconnect it before removal.

When reinstalling, make certain the belt brackets are squarely placed and that the belt is not twisted or backwards. Check the extension and retraction of belts before final tightening any bolts.

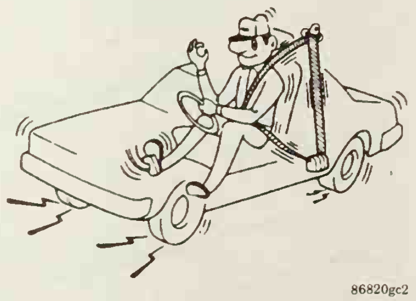


Fig. 93 In a safe location, drive the vehicle at about 10 mph (16 kph). Apply the brakes very hard; the belt should lock and restrain you in the seat

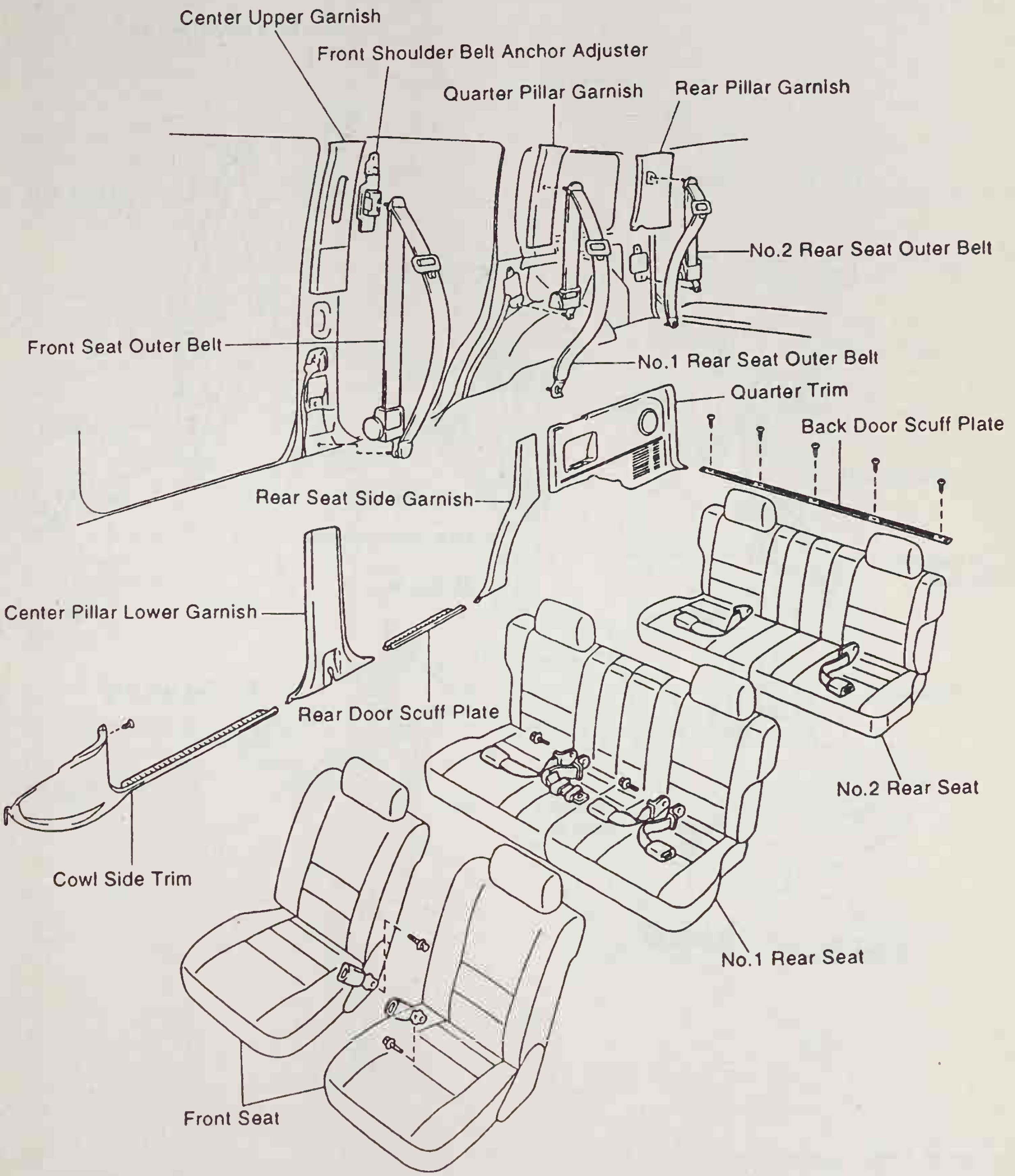

Center Upper Garnish
Front Shoulder Belt Anchor Adjuster
Quarter Pillar Garnish
Rear Pillar Garnish
No.2 Rear Seat Outer Belt
Front Seat Outer Belt
No.1 Rear Seat Outer Belt
Quarter Trim
Back Door Scuff Plate
Rear Seat Side Garnish
Center Pillar Lower Garnish
Rear Door Scuff Plate
No.2 Rear Seat
Cowl Side Trim
No.1 Rear Seat
Front Seat
86820gc7

Fig. 94 Exploded view of the seat belts and components — Land Cruiser

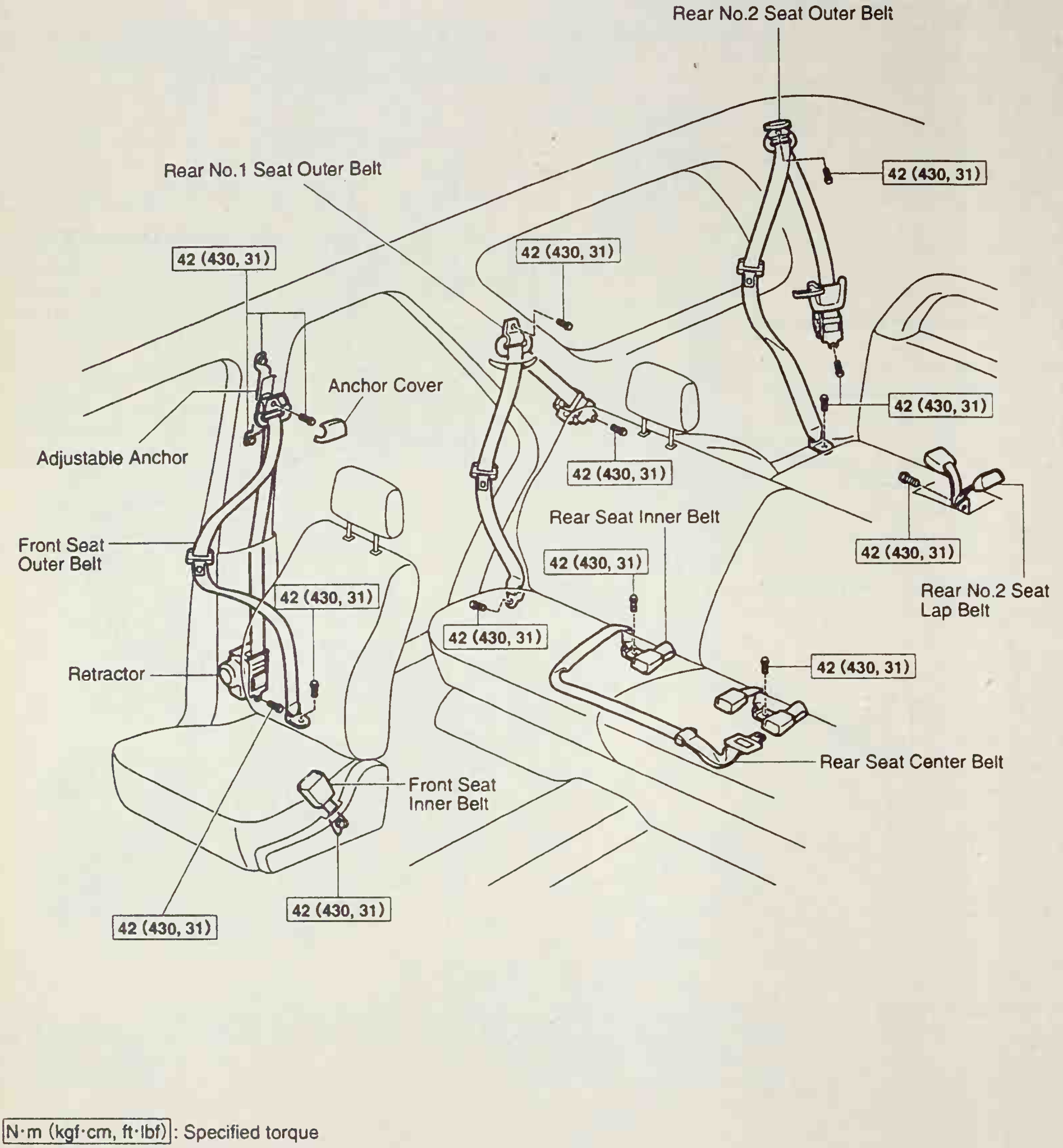

Rear No.2 Seat Outer Belt
42 (430, 31)
Rear No.1 Seat Outer Belt
42 (430, 31)
42 (430, 31)
Anchor Cover
Adjustable Anchor
42 (430, 31)
42 (430, 31)
Front Seat Outer Belt
Rear Seat Inner Belt
42 (430, 31)
42 (430, 31)
Rear No.2 Seat Lap Belt
42 (430, 31)
42 (430, 31)
Retractor
42 (430, 31)
Rear Seat Center Belt
Front Seat Inner Belt
42 (430, 31)
42 (430, 31)
N·m (kgf·cm, ft·lbf) : Specified torque
86820gd5

Fig. 95 Exploded view of the seat belts and components — 4Runner

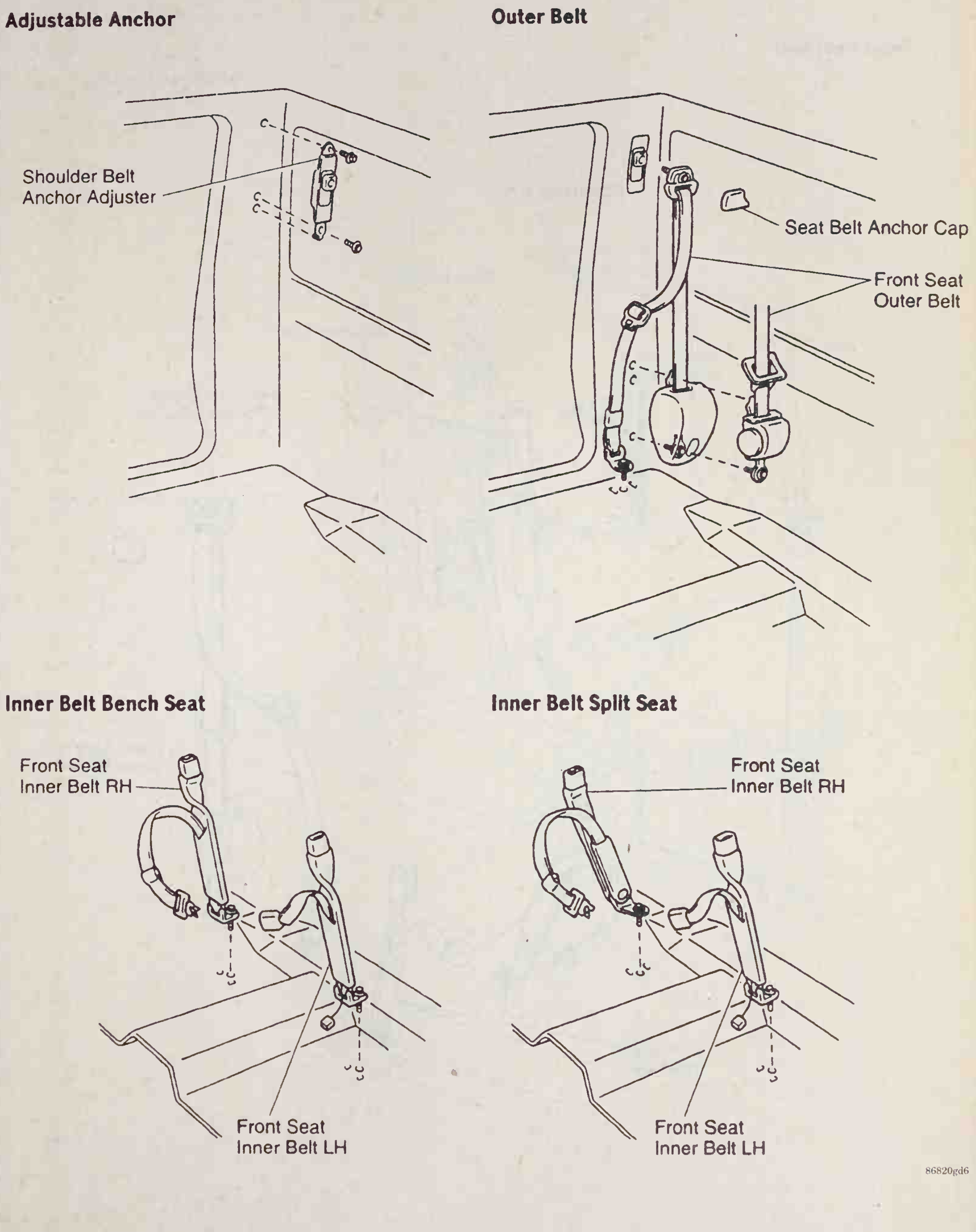

Adjustable Anchor
Shoulder Belt Anchor Adjuster
Outer Belt
Seat Belt Anchor Cap
Front Seat Outer Belt
Inner Belt Bench Seat
Front Seat Inner Belt RH
Front Seat Inner Belt LH
Inner Belt Split Seat
Front Seat Inner Belt RH
Front Seat Inner Belt LH
86820gd6

Fig. 96 Exploded view of the front seat belts and components — T100

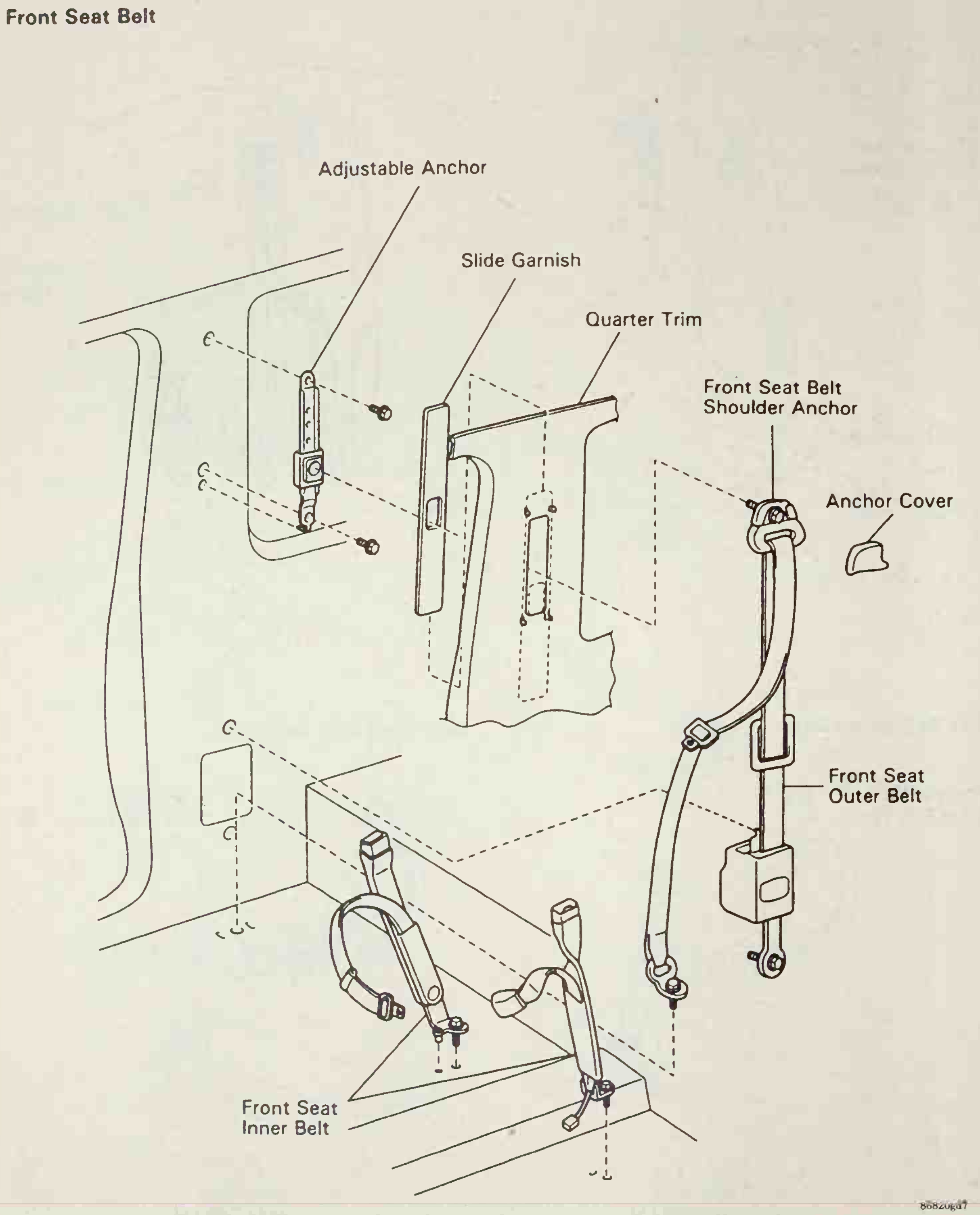

Front Seat Belt
Adjustable Anchor
Slide Garnish
Quarter Trim
Front Seat Belt Shoulder Anchor
Anchor Cover
Front Seat Outer Belt
Front Seat Inner Belt
86820gd7

Fig. 97 Exploded view of the front X-tra cab seat belts and components — T100

Rear Seat Belt

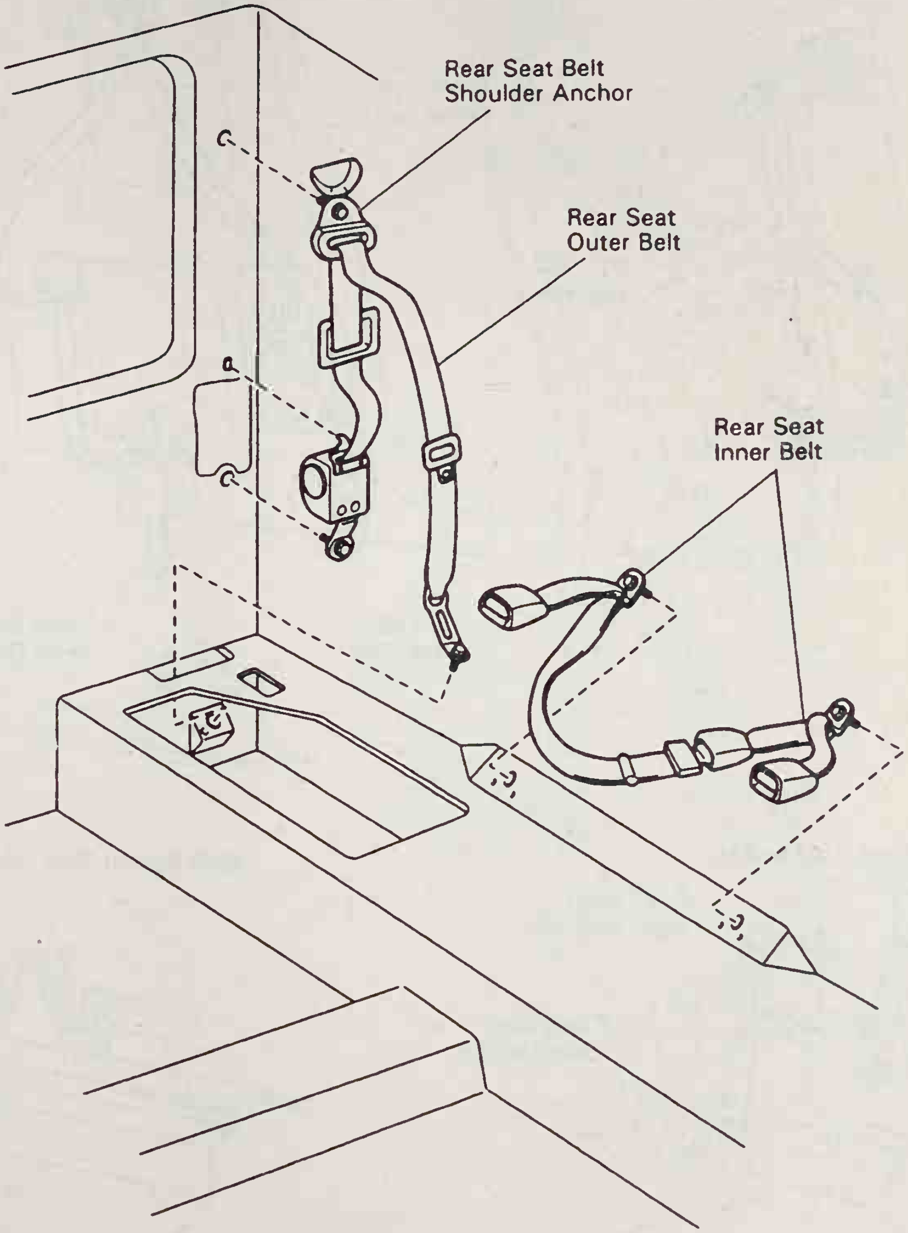

Rear Seat Belt
Shoulder Anchor
Rear Seat
Outer Belt
Rear Seat
Inner Belt
86820gd8

Fig. 98 Exploded view of the rear X-tra cab seat belts and components — T100

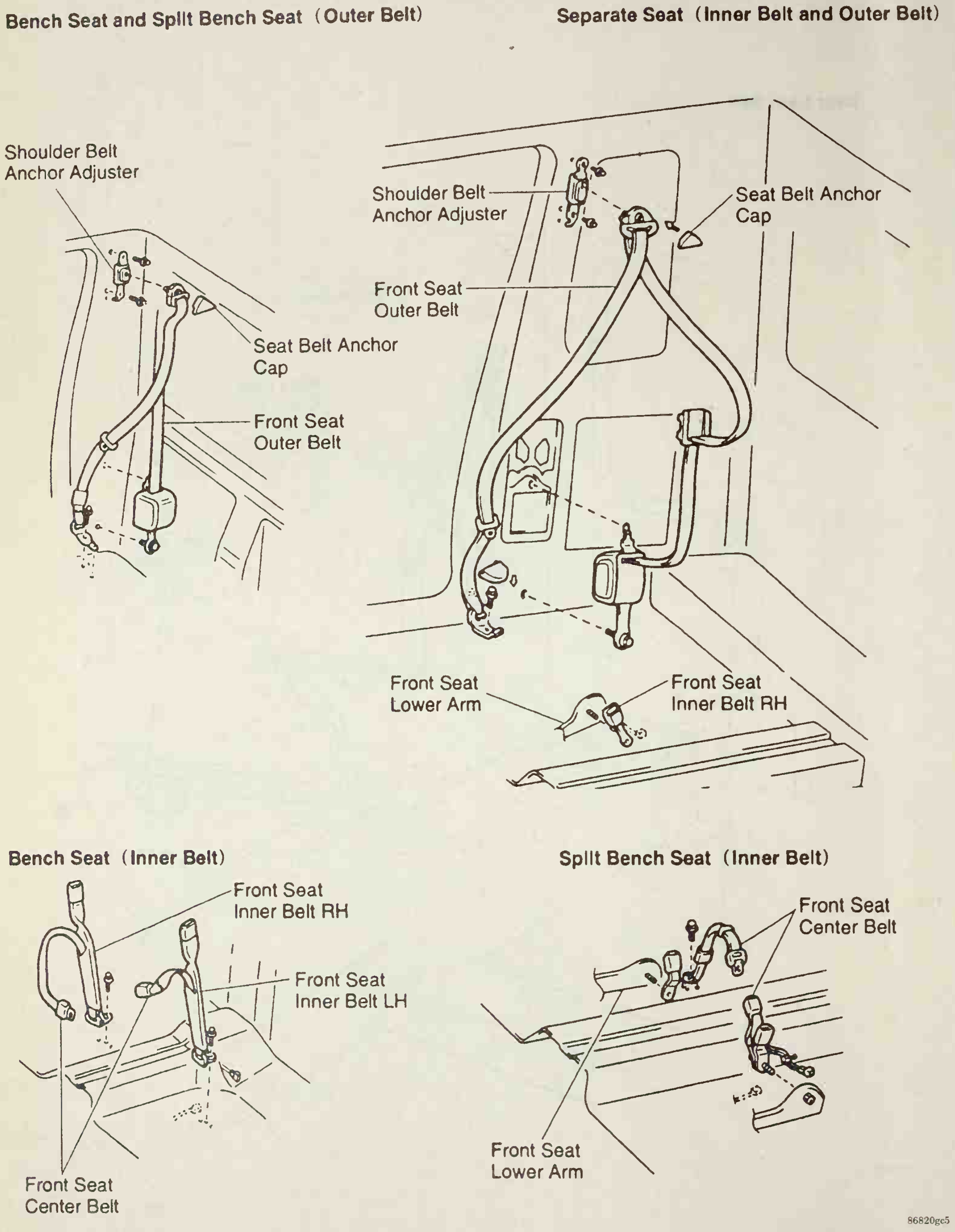

Bench Seat and Split Bench Seat (Outer Belt)
Shoulder Belt Anchor Adjuster
Seat Belt Anchor Cap
Front Seat Outer Belt
Separate Seat (Inner Belt and Outer Belt)
Shoulder Belt Anchor Adjuster
Seat Belt Anchor Cap
Front Seat Outer Belt
Front Seat Lower Arm
Front Seat Inner Belt RH
Bench Seat (Inner Belt)
Front Seat Inner Belt RH
Front Seat Inner Belt LH
Front Seat Center Belt
Split Bench Seat (Inner Belt)
Front Seat Center Belt
Front Seat Lower Arm
86820gc5

Fig. 99 Exploded view of the front seat belts and components — Tacoma

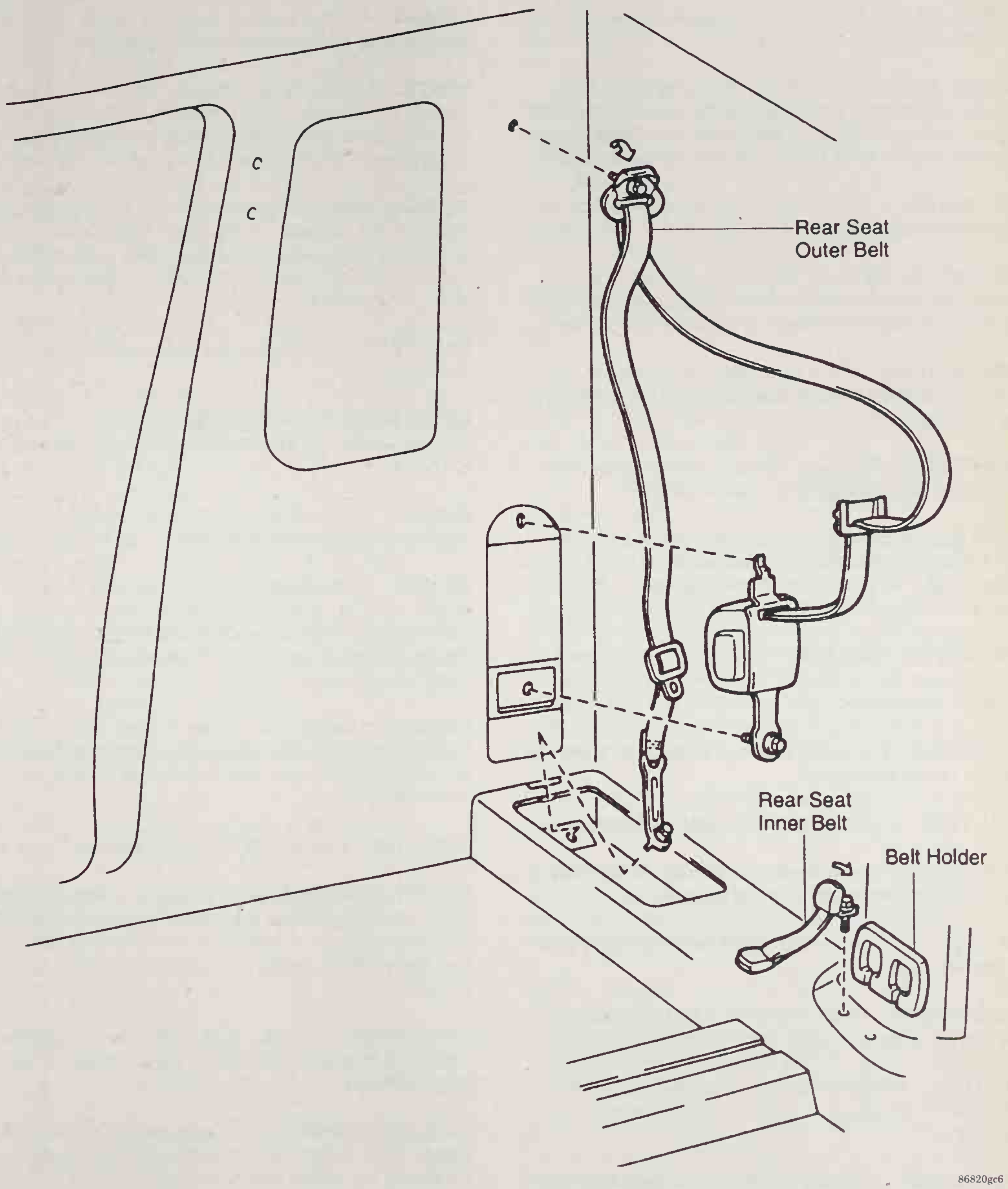

Rear Seat
Outer Belt
Rear Seat
Inner Belt
Belt Holder
86820gc6

Fig. 100 Exploded view of the rear seat belts and components — Tacoma

GLOSSARY

AIR/FUEL RATIO: The ratio of air-to-gasoline by weight in the fuel mixture drawn into the engine.

AIR INJECTION: One method of reducing harmful exhaust emissions by injecting air into each of the exhaust ports of an engine. The fresh air entering the hot exhaust manifold causes any remaining fuel to be burned before it can exit the tailpipe.

ALTERNATOR: A device used for converting mechanical energy into electrical energy.

AMMETER: An instrument, calibrated in amperes, used to measure the flow of an electrical current in a circuit. Ammeters are always connected in series with the circuit being tested.

AMPERE: The rate of flow of electrical current present when one volt of electrical pressure is applied against one ohm of electrical resistance.

ANALOG COMPUTER: Any microprocessor that uses similar (analogous) electrical signals to make its calculations.

ARMATURE: A laminated, soft iron core wrapped by a wire that converts electrical energy to mechanical energy as in a motor or relay. When rotated in a magnetic field, it changes mechanical energy into electrical energy as in a generator.

ATMOSPHERIC PRESSURE: The pressure on the Earth's surface caused by the weight of the air in the atmosphere. At sea level, this pressure is 14.7 psi at 32°F (101 kPa at 0°C).

ATOMIZATION: The breaking down of a liquid into a fine mist that can be suspended in air.

AXIAL PLAY: Movement parallel to a shaft or bearing bore.

BACKFIRE: The sudden combustion of gases in the intake or exhaust system that results in a loud explosion.

BACKLASH: The clearance or play between two parts, such as meshed gears.

BACKPRESSURE: Restrictions in the exhaust system that slow the exit of exhaust gases from the combustion chamber.

BAKELITE: A heat resistant, plastic insulator material commonly used in printed circuit boards and transistorized components.

BALL BEARING: A bearing made up of hardened inner and outer races between which hardened steel balls roll.

BALLAST RESISTOR: A resistor in the primary ignition circuit that lowers voltage after the engine is started to reduce wear on ignition components.

BEARING: A friction reducing, supportive device usually located between a stationary part and a moving part.

BIMETAL TEMPERATURE SENSOR: Any sensor or switch made of two dissimilar types of metal that bend when heated or cooled due to the different expansion rates of the alloys. These types of sensors usually function as an on/off switch.

BLOWBY: Combustion gases, composed of water vapor and unburned fuel, that leak past the piston rings into the crankcase during normal engine operation. These gases are removed by the PCV system to prevent the buildup of harmful acids in the crankcase.

BRAKE PAD: A brake shoe and lining assembly used with disc brakes.

BRAKE SHOE: The backing for the brake lining. The term is, however, usually applied to the assembly of the brake backing and lining.

BUSHING: A liner, usually removable, for a bearing; an anti-friction liner used in place of a bearing.

CALIPER: A hydraulically activated device in a disc brake system, which is mounted straddling the brake rotor (disc). The caliper contains at least one piston and two brake pads. Hydraulic pressure on the piston(s) forces the pads against the rotor.

CAMSHAFT: A shaft in the engine on which are the lobes (cams) which operate the valves. The camshaft is driven by the crankshaft, via a belt, chain or gears, at one half the crankshaft speed.

CAPACITOR: A device which stores an electrical charge.

CARBON MONOXIDE (CO): A colorless, odorless gas given off as a normal byproduct of combustion. It is poisonous and extremely dangerous in confined areas, building up slowly to toxic levels without warning if adequate ventilation is not available.

CARBURETOR: A device, usually mounted on the intake manifold of an engine, which mixes the air and fuel in the proper proportion to allow even combustion.

CATALYTIC CONVERTER: A device installed in the exhaust system, like a muffler, that converts harmful byproducts of combustion into carbon dioxide and water vapor by means of a heat-producing chemical reaction.

CENTRIFUGAL ADVANCE: A mechanical method of advancing the spark timing by using flyweights in the distributor that react to centrifugal force generated by the distributor shaft rotation.

CHECK VALVE: Any one-way valve installed to permit the flow of air, fuel or vacuum in one direction only.

CHOKE: A device, usually a moveable valve, placed in the intake path of a carburetor to restrict the flow of air.

CIRCUIT: Any unbroken path through which an electrical current can flow. Also used to describe fuel flow in some instances.

CIRCUIT BREAKER: A switch which protects an electrical circuit from overload by opening the circuit when the current flow exceeds a predetermined level. Some circuit breakers must be reset manually, while most reset automatically.

COIL (IGNITION): A transformer in the ignition circuit which steps up the voltage provided to the spark plugs.

COMBINATION MANIFOLD: An assembly which includes both the intake and exhaust manifolds in one casting.

COMBINATION VALVE: A device used in some fuel systems that routes fuel vapors to a charcoal storage canister instead of venting them into the atmosphere. The valve relieves fuel tank pressure and allows fresh air into the tank as the fuel level drops to prevent a vapor lock situation.

COMPRESSION RATIO: The comparison of the total volume of the cylinder and combustion chamber with the piston at BDC and the piston at TDC.

CONDENSER: 1. An electrical device which acts to store an electrical charge, preventing voltage surges. 2. A radiator-like device in the air conditioning system in which refrigerant gas condenses into a liquid, giving off heat.

CONDUCTOR: Any material through which an electrical current can be transmitted easily.

CONTINUITY: Continuous or complete circuit. Can be checked with an ohmmeter.

COUNTERSHAFT: An intermediate shaft which is rotated by a mainshaft and transmits, in turn, that rotation to a working part.

CRANKCASE: The lower part of an engine in which the crankshaft and related parts operate.

CRANKSHAFT: The main driving shaft of an engine which receives reciprocating motion from the pistons and converts it to rotary motion.

CYLINDER: In an engine, the round hole in the engine block in which the piston(s) ride.

CYLINDER BLOCK: The main structural member of an engine in which is found the cylinders, crankshaft and other principal parts.

CYLINDER HEAD: The detachable portion of the engine, usually fastened to the top of the cylinder block and containing all or most of the combustion chambers. On overhead valve engines, it contains the valves and their operating parts. On overhead cam engines, it contains the camshaft as well.

DEAD CENTER: The extreme top or bottom of the piston stroke.

DETONATION: An unwanted explosion of the air/fuel mixture in the combustion chamber caused by excess heat and compression, advanced timing, or an overly lean mixture. Also referred to as "ping".

DIAPHRAGM: A thin, flexible wall separating two cavities, such as in a vacuum advance unit.

DIESELING: A condition in which hot spots in the combustion chamber cause the engine to run on after the key is turned off.

DIFFERENTIAL: A geared assembly which allows the transmission of motion between drive axles, giving one axle the ability to turn faster than the other.

DIODE: An electrical device that will allow current to flow in one direction only.

DISC BRAKE: A hydraulic braking assembly consisting of a brake disc, or rotor, mounted on an axle, and a caliper assembly containing, usually two brake pads which are activated by hydraulic pressure. The pads are forced against the sides of the disc, creating friction which slows the vehicle.

DISTRIBUTOR: A mechanically driven device on an engine which is responsible for electrically firing the spark plug at a predetermined point of the piston stroke.

DOWEL PIN: A pin, inserted in mating holes in two different parts allowing those parts to maintain a fixed relationship.

DRUM BRAKE: A braking system which consists of two brake shoes and one or two wheel cylinders, mounted on a fixed backing plate, and a brake drum, mounted on an axle, which revolves around the assembly.

DWELL: The rate, measured in degrees of shaft rotation, at which an electrical circuit cycles on and off.

ELECTRONIC CONTROL UNIT (ECU): Ignition module, module, amplifier or igniter. See Module for definition.

ELECTRONIC IGNITION: A system in which the timing and firing of the spark plugs is controlled by an electronic control unit, usually called a module. These systems have no points or condenser.

END-PLAY: The measured amount of axial movement in a shaft.

ENGINE: A device that converts heat into mechanical energy.

EXHAUST MANIFOLD: A set of cast passages or pipes which conduct exhaust gases from the engine.

FEELER GAUGE: A blade, usually metal, of precisely predetermined thickness, used to measure the clearance between two parts.

FIRING ORDER: The order in which combustion occurs in the cylinders of an engine. Also the order in which spark is distributed to the plugs by the distributor.

FLOODING: The presence of too much fuel in the intake manifold and combustion chamber which prevents the air/fuel mixture from firing, thereby causing a no-start situation.

FLYWHEEL: A disc shaped part bolted to the rear end of the crankshaft. Around the outer perimeter is affixed the ring gear. The starter drive engages the ring gear, turning the flywheel, which rotates the crankshaft, imparting the initial starting motion to the engine.

FOOT POUND (ft. lbs. or sometimes, ft.lb.): The amount of energy or work needed to raise an item weighing one pound, a distance of one foot.

FUSE: A protective device in a circuit which prevents circuit overload by breaking the circuit when a specific amperage is present. The device is constructed around a strip or wire of a lower amperage rating than the circuit it is designed to protect. When an amperage higher than that stamped on the fuse is present in the circuit, the strip or wire melts, opening the circuit.

GEAR RATIO: The ratio between the number of teeth on meshing gears.

GENERATOR: A device which converts mechanical energy into electrical energy.

HEAT RANGE: The measure of a spark plug's ability to dissipate heat from its firing end. The higher the heat range, the hotter the plug fires.

HUB: The center part of a wheel or gear.

HYDROCARBON (HC): Any chemical compound made up of hydrogen and carbon. A major pollutant formed by the engine as a byproduct of combustion.

HYDROMETER: An instrument used to measure the specific gravity of a solution.

INCH POUND (inch lbs.; sometimes in.lb. or in. lbs.): One twelfth of a foot pound.

INDUCTION: A means of transferring electrical energy in the form of a magnetic field. Principle used in the ignition coil to increase voltage.

INJECTOR: A device which receives metered fuel under relatively low pressure and is activated to inject the fuel into the engine under relatively high pressure at a predetermined time.

INPUT SHAFT: The shaft to which torque is applied, usually carrying the driving gear or gears.

INTAKE MANIFOLD: A casting of passages or pipes used to conduct air or a fuel/air mixture to the cylinders.

JOURNAL: The bearing surface within which a shaft operates.

KEY: A small block usually fitted in a notch between a shaft and a hub to prevent slippage of the two parts.

MANIFOLD: A casting of passages or set of pipes which connect the cylinders to an inlet or outlet source.

MANIFOLD VACUUM: Low pressure in an engine intake manifold formed just below the throttle plates. Manifold vacuum is highest at idle and drops under acceleration.

MASTER CYLINDER: The primary fluid pressurizing device in a hydraulic system. In automotive use, it is found in brake and hydraulic clutch systems and is pedal activated, either directly or, in a power brake system, through the power booster.

MODULE: Electronic control unit, amplifier or igniter of solid state or integrated design which controls the current flow in the ignition primary circuit based on input from the pick-up coil. When the module opens the primary circuit, high secondary voltage is induced in the coil.

NEEDLE BEARING: A bearing which consists of a number (usually a large number) of long, thin rollers.

OHM:(Ω) The unit used to measure the resistance of conductor-to-electrical flow. One ohm is the amount of resistance that limits current flow to one ampere in a circuit with one volt of pressure.

OHMMETER: An instrument used for measuring the resistance, in ohms, in an electrical circuit.

OUTPUT SHAFT: The shaft which transmits torque from a device, such as a transmission.

OVERDRIVE: A gear assembly which produces more shaft revolutions than that transmitted to it.

OVERHEAD CAMSHAFT (OHC): An engine configuration in which the camshaft is mounted on top of the cylinder head and operates the valve either directly or by means of rocker arms.

OVERHEAD VALVE (OHV): An engine configuration in which all of the valves are located in the cylinder head and the camshaft is located in the cylinder block. The camshaft operates the valves via lifters and pushrods.

OXIDES OF NITROGEN (NOx): Chemical compounds of nitrogen produced as a byproduct of combustion. They combine with hydrocarbons to produce smog.

OXYGEN SENSOR: Used with the feedback system to sense the presence of oxygen in the exhaust gas and signal the computer which can reference the voltage signal to an air/fuel ratio.

PINION: The smaller of two meshing gears.

PISTON RING: An open-ended ring which fits into a groove on the outer diameter of the piston. Its chief function is to form a seal between the piston and cylinder wall. Most automotive pistons have three rings: two for compression sealing; one for oil sealing.

PRELOAD: A predetermined load placed on a bearing during assembly or by adjustment.

PRIMARY CIRCUIT: The low voltage side of the ignition system which consists of the ignition switch, ballast resistor or resistance wire, bypass, coil, electronic control unit and pick-up coil as well as the connecting wires and harnesses.

PRESS FIT: The mating of two parts under pressure, due to the inner diameter of one being smaller than the outer diameter of the other, or vice versa; an interference fit.

RACE: The surface on the inner or outer ring of a bearing on which the balls, needles or rollers move.

REGULATOR: A device which maintains the amperage and/or voltage levels of a circuit at predetermined values.

RELAY: A switch which automatically opens and/or closes a circuit.

RESISTANCE: The opposition to the flow of current through a circuit or electrical device, and is measured in ohms. Resistance is equal to the voltage divided by the amperage.

RESISTOR: A device, usually made of wire, which offers a preset amount of resistance in an electrical circuit.

RING GEAR: The name given to a ring-shaped gear attached to a differential case, or affixed to a flywheel or as part of a planetary gear set.

ROLLER BEARING: A bearing made up of hardened inner and outer races between which hardened steel rollers move.

ROTOR: 1. The disc-shaped part of a disc brake assembly, upon which the brake pads bear; also called, brake disc. 2. The device mounted atop the distributor shaft, which passes current to the distributor cap tower contacts.

SECONDARY CIRCUIT: The high voltage side of the ignition system, usually above 20,000 volts. The secondary includes the ignition coil, coil wire, distributor cap and rotor, spark plug wires and spark plugs.

SENDING UNIT: A mechanical, electrical, hydraulic or electromagnetic device which transmits information to a gauge.

SENSOR: Any device designed to measure engine operating conditions or ambient pressures and temperatures. Usually electronic in nature and designed to send a voltage signal to an on-board computer, some sensors may operate as a simple on/off switch or they may provide a variable voltage signal (like a potentiometer) as conditions or measured parameters change.

SHIM: Spacers of precise, predetermined thickness used between parts to establish a proper working relationship.

SLAVE CYLINDER: In automotive use, a device in the hydraulic clutch system which is activated by hydraulic force, disengaging the clutch.

SOLENOID: A coil used to produce a magnetic field, the effect of which is to produce work.

SPARK PLUG: A device screwed into the combustion chamber of a spark ignition engine. The basic construction is a conductive core inside of a ceramic insulator, mounted in an outer conductive base. An electrical charge from the spark plug wire travels along the conductive core and jumps a preset air gap to a grounding point or points at the end of the conductive base. The resultant spark ignites the fuel/air mixture in the combustion chamber.

SPLINES: Ridges machined or cast onto the outer diameter of a shaft or inner diameter of a bore to enable parts to mate without rotation.

TACHOMETER: A device used to measure the rotary speed of an engine, shaft, gear, etc., usually in rotations per minute.

THERMOSTAT: A valve, located in the cooling system of an engine, which is closed when cold and opens gradually in response to engine heating, controlling the temperature of the coolant and rate of coolant flow.

TOP DEAD CENTER (TDC): The point at which the piston reaches the top of its travel on the compression stroke.

TORQUE: The twisting force applied to an object.

TORQUE CONVERTER: A turbine used to transmit power from a driving member to a driven member via hydraulic action, providing changes in drive ratio and torque. In automotive use, it links the driveplate at the rear of the engine to the automatic transmission.

TRANSDUCER: A device used to change a force into an electrical signal.

TRANSISTOR: A semi-conductor component which can be actuated by a small voltage to perform an electrical switching function.

TUNE-UP: A regular maintenance function, usually associated with the replacement and adjustment of parts and components in the electrical and fuel systems of a vehicle for the purpose of attaining optimum performance.

TURBOCHARGER: An exhaust driven pump which compresses intake air and forces it into the combustion chambers at higher than atmospheric pressures. The increased air pressure allows more fuel to be burned and results in increased horsepower being produced.

VACUUM ADVANCE: A device which advances the ignition timing in response to increased engine vacuum.

VACUUM GAUGE: An instrument used to measure the presence of vacuum in a chamber.

VALVE: A device which control the pressure, direction of flow or rate of flow of a liquid or gas.

VALVE CLEARANCE: The measured gap between the end of the valve stem and the rocker arm, cam lobe or follower that activates the valve.

VISCOSITY: The rating of a liquid's internal resistance to flow.

VOLTMETER: An instrument used for measuring electrical force in units called volts. Voltmeters are always connected parallel with the circuit being tested.

WHEEL CYLINDER: Found in the automotive drum brake assembly, it is a device, actuated by hydraulic pressure, which, through internal pistons, pushes the brake shoes outward against the drums.

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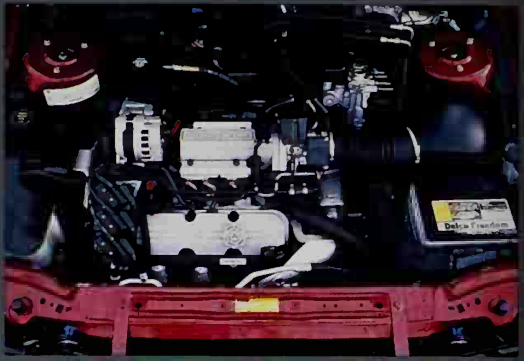

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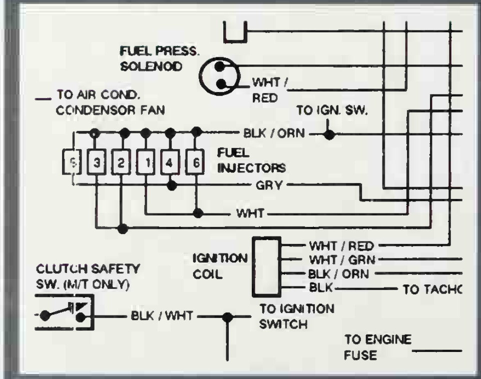
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